COMHAIRLE CHONDAE AN CABHÁIN

Cavan County Council

Annual Environmental Report 2012

Bailieborough Landfill WL0091-1

Document Title	Annual Environmental Report 2012 Bailieborough Landfill WL0091-1		
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03	Final Issue	BK/CB	25/03/13

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to prepare the following Annual Environmental Report.

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1.0 INTRODUCTION

Bailieborough Landfill has been operated as waste disposal facility by Cavan County Council since the late 1960s. The landfill is located on the outskirts of the town of Bailieborough, (c. 1 km from town centre), in the town land of Tanderagee, which was a commercially exploited bog. The site was operated as a traditional landfill constructed on peat and relies on the properties of the peat bog for attenuation, dilution and dispersal. The total area of the site comprises 2.23 hectares.

A Waste Licence for the facility was issued by the EPA on 22nd February 2002, when the site officially closed and was thereafter remediated. Condition 11.6 of Waste Licence Ref. 91-1 requires the submission of an Annual Environmental Report (AER) for Bailieborough Landfill facility. This document is produced in order to comply with requirements of Condition 11.6.

The requirements for reporting of Annual Environmental Information arise under individual EPA licences issued under the EPA Acts 1992 – 2008, the Waste Management Acts 1996 – 2008 and other legislation.

This AER will provide information as outlined in Schedule F of the Licence "Content of the Annual Environmental Report".

2.0 REPORTING PERIOD

The reporting period for the purpose of this AER is 01st January 2012 - 31st December 2012.

3.0 WASTE ACTIVITIES CARRIED OUT AT THE FACILITY

There were no waste activities carried out at the facility.

4.0 QUANTITY AND COMPOSITION OF THE WASTE

There is no longer any waste being accepted at the site. The quantity of waste accepted is zero tonnes.

5.0 SUMMARY REPORT ON EMISSIONS

The PRTR Regulations are the European Communities (European Pollutant Release and Transfer Register) Regulation 2007, S.I. No. 123 of 2007), which signed into Irish Law on 22 March 2007 the E-PRTR Regulation, (EC) No 166/2006, concerning the establishment of a European Pollutant Release and Transfer Register. The summary of emissions is detailed in the (PRTR) Report which appears in Appendix A of this report. The PRTR has been uploaded onto the EPA website in accordance with our responsibility as Licensee.

Cavan County Council now carries out the full scope of sampling as required by the Licence. Monitoring had been reduced at the time of the restoration works and the full sampling regime had not been re-established until late 2009 when advised by the Agency.

5.1 Surface Water

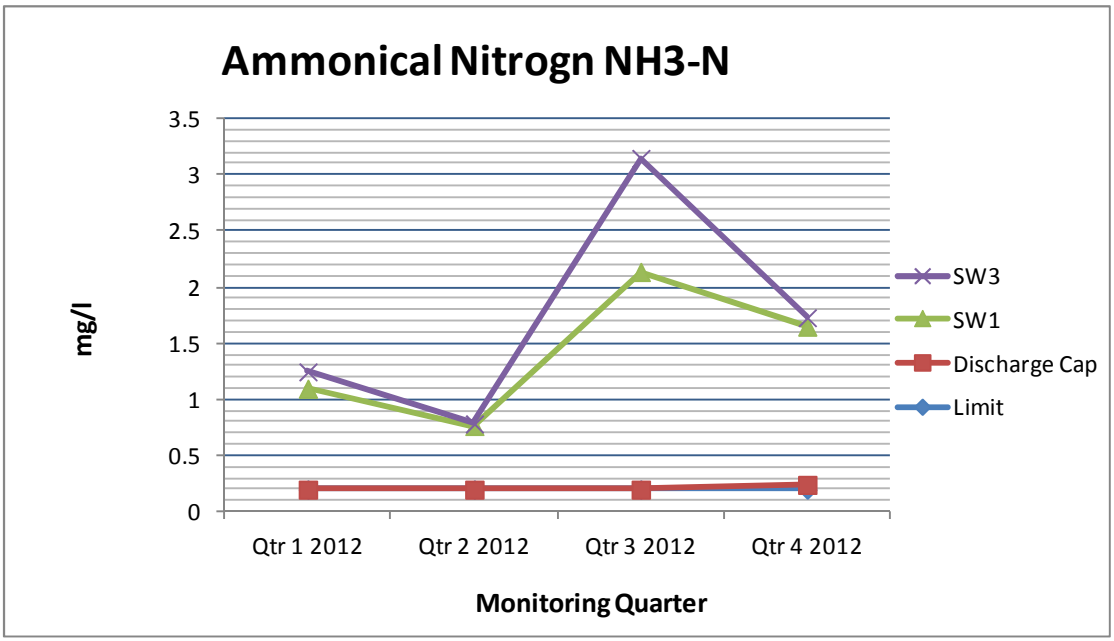
All monitoring locations are detailed in the site map which is presented in Appendix B.

As table 5.1 shows there was a high Ammonia, COD, Iron and Manganese levels recorded in the samples taken at the discharge cap, SW1 and SW3. SW1 is located downstream of the landfill while SW3 is located further downstream at the new monitoring location SW3 “Chapel Lough”.

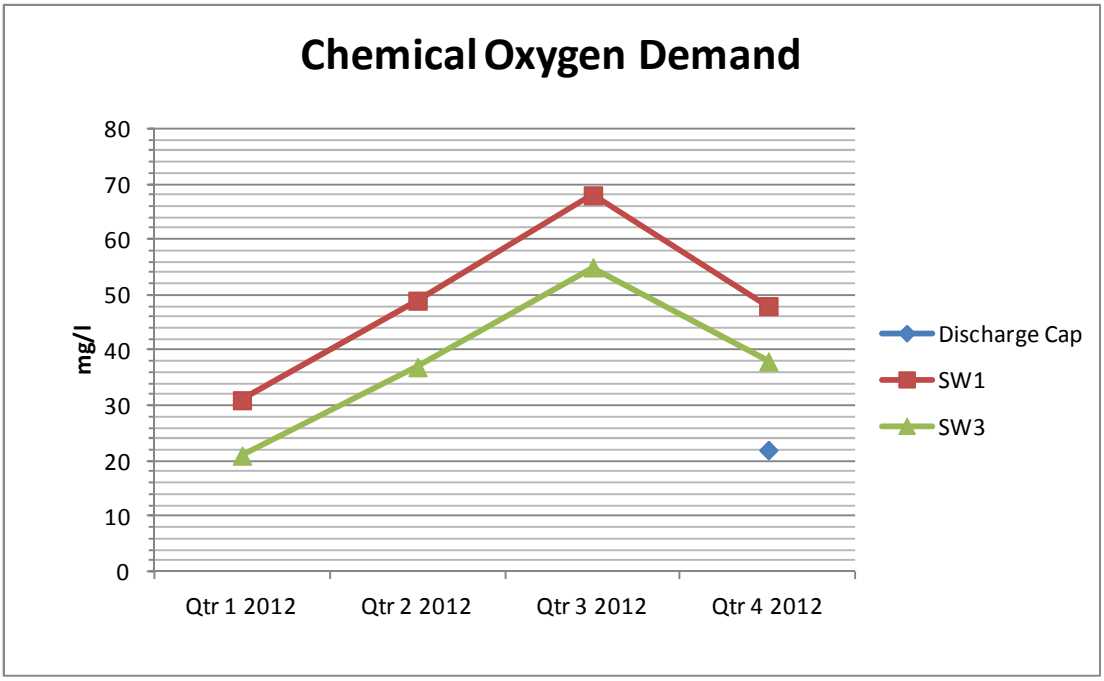
Table 5.1 Surface water summary results

	Parameter	Ammonia	COD	Fe	Mn
	Units	mg/l N	mg/l	ug/l	ug/l
Discharge Cap	Qtr 4 2012	0.041	22	145	119
	Qtr 3 2012	-	-	-	-
	Qtr 2 2012	-	-	-	-
	Qtr 1 2012	-	-	-	-
SW1	Qtr 4 2012	1.409	48	742	259
	Qtr 3 2012	1.936	68	4114	1121
	Qtr 2 2012	0.565	49	704	354
	Qtr 1 2012	0.897	31	529	273
SW3	Qtr 4 2012	0.078	38	223	54
	Qtr 3 2012	1.011	55	1239	2180
	Qtr 2 2012	0.019	37	1085	757
	Qtr 1 2012	0.15	21	287	872
S.I No 294/1989		0.2	40	200	50

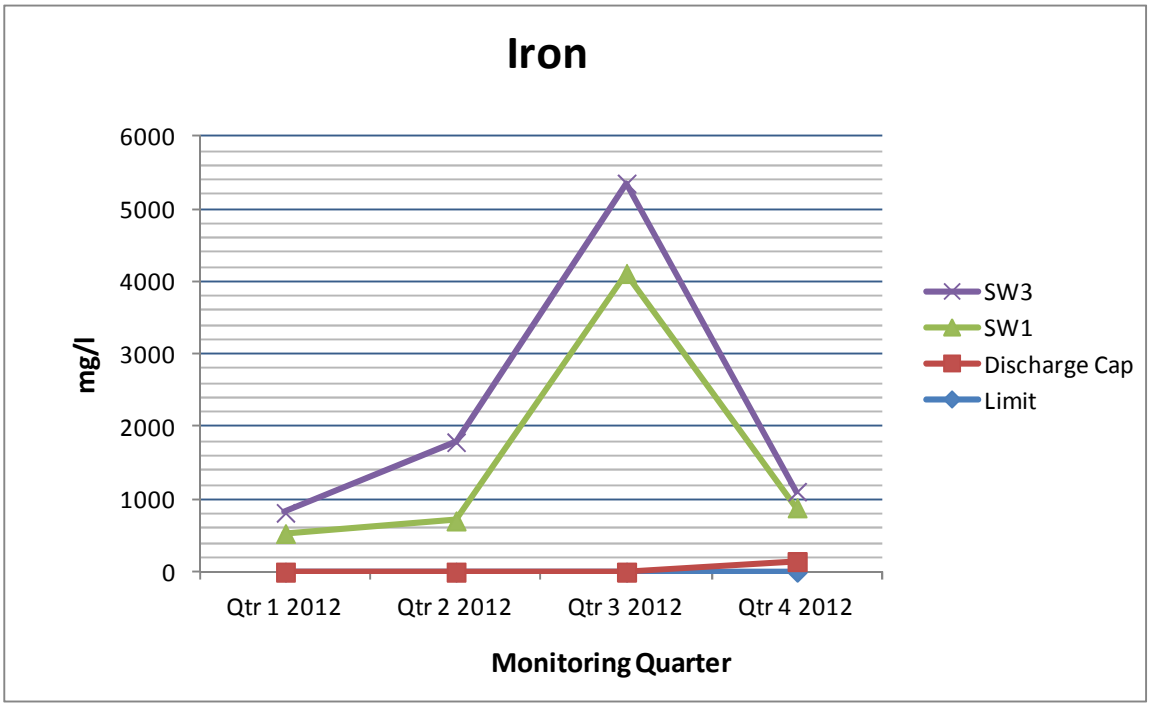
Graph 5.1



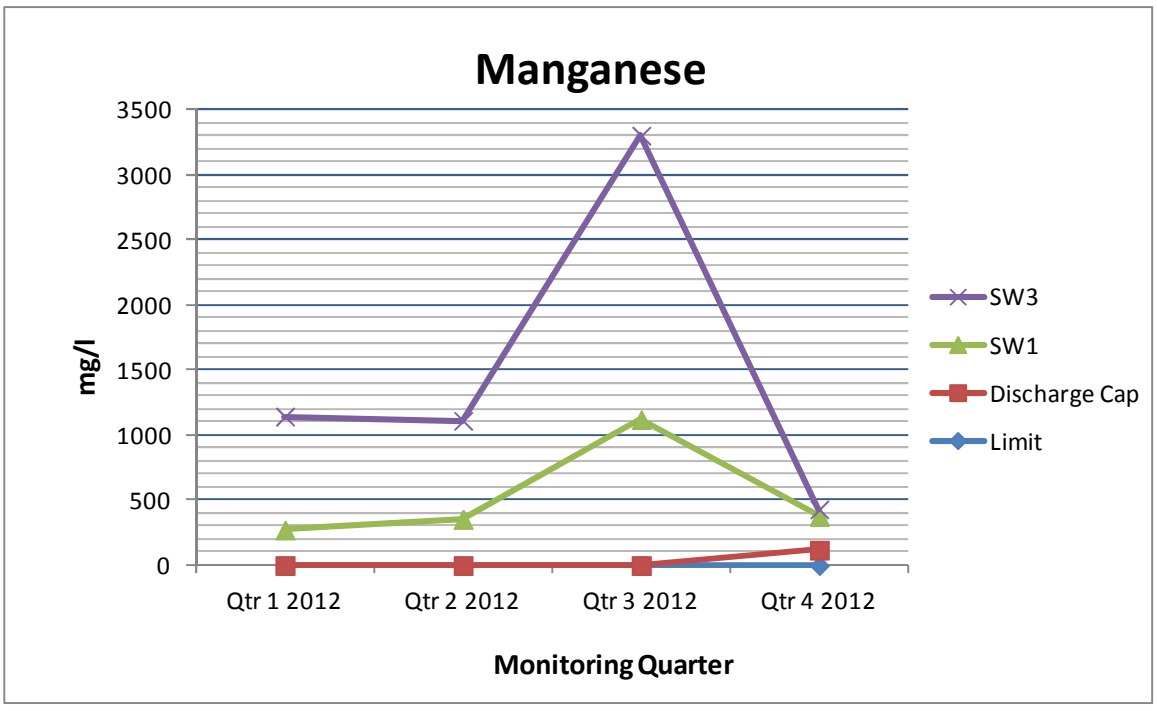
Graph 5.2



Graph 5.3



Graph 5.4



Elevated levels of Iron and Manganese can be attributed to the natural composition of the underlying geology however it is not uncommon to encounter high levels of both parameters in the vicinity of landfills. The elevated level of Ammonia in Cap discharge sample during quarter 4 is attributed to the extremely low flow from the cap discharge. It is suspected that these samples may have been partially stagnant. It should be noted that it is extremely difficult to obtain a sample from this location due to low flows from the discharge cap.

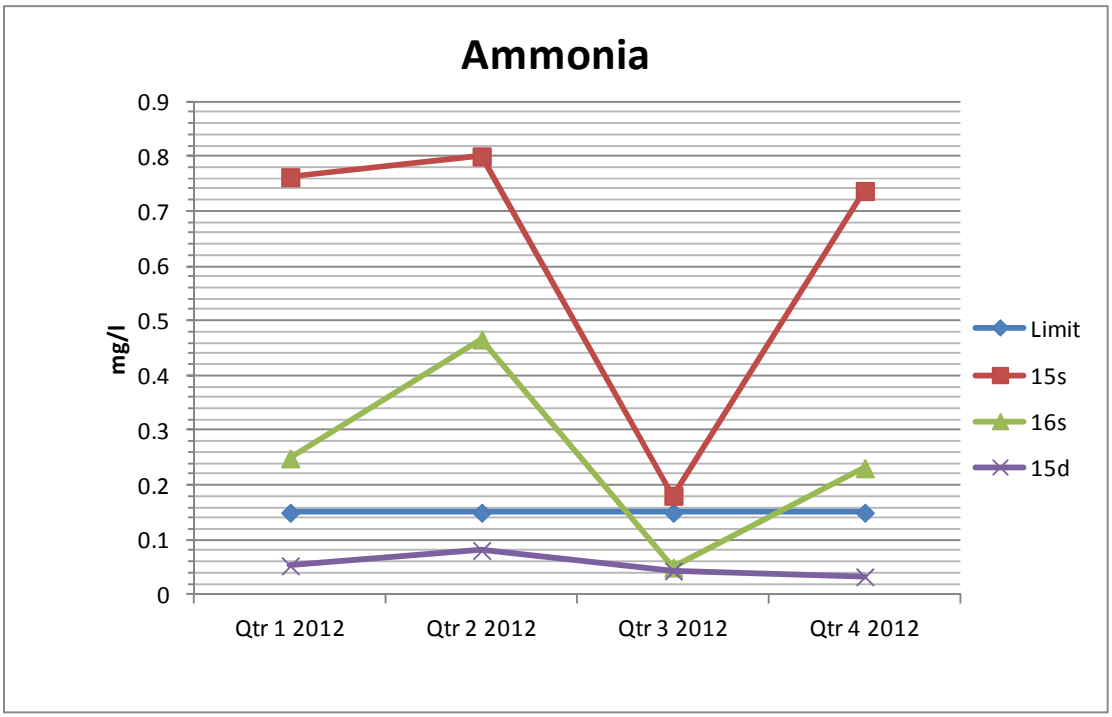
5.2 Groundwater

The following table details all reoccurring exceedances at groundwater wells during 2012. Results in Hatched Red indicate where the interim guide value has been exceeded when compared to limits stipulated by the Environmental Protection Agency.

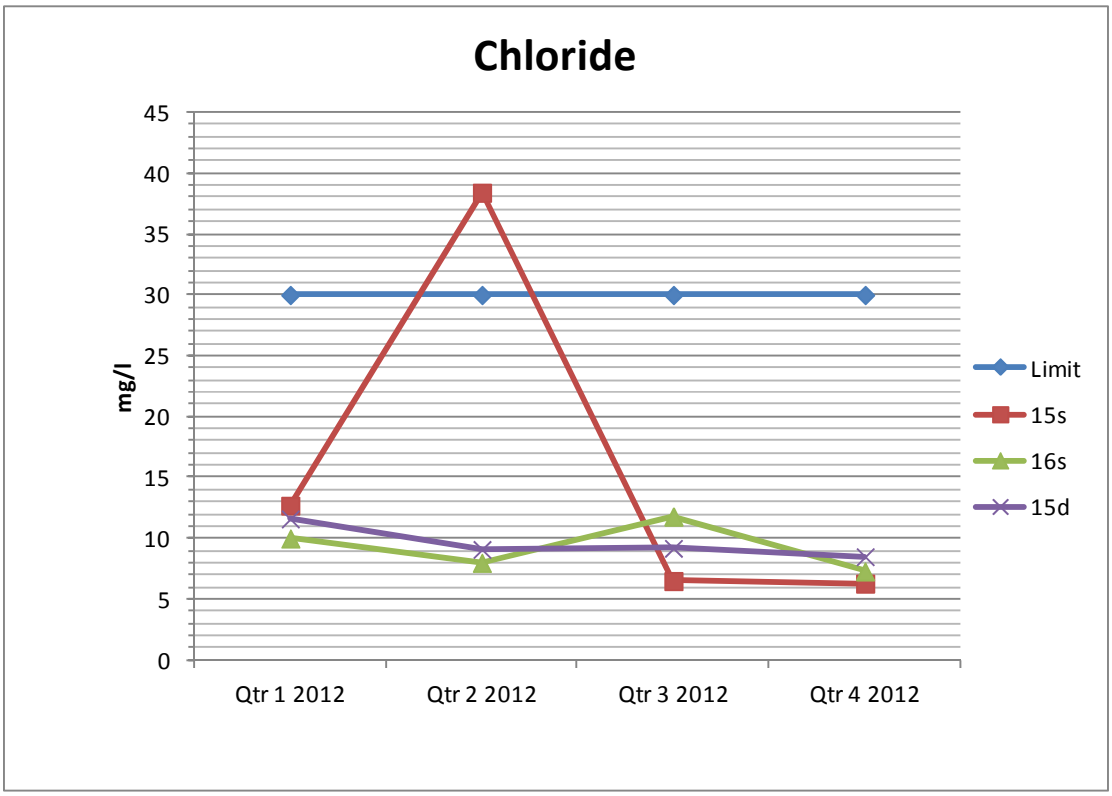
Table 5.2 Groundwater Summary Results

	Parameter	Ammonia	pH	Cl	Fe	Mn	K
	Units	mg/l N	pH Units	mg/l	ug/l	ug/l	mg/l
WELL 10 D	Qtr 4 2012	0.042	7.9	5.7	37.1	119.5	2.6
	Qtr 3 2012	0.052	8	8.6	69.7	137.9	2.7
	Qtr 2 2012	0.8	6	38.4	8955	604.7	5.3
	Qtr 1 2012	0.037	7.9	9.2	20	100	2.9
WELL 10 S	Qtr 4 2012	-	-	-	-	-	-
	Qtr 3 2012	0.749	5.9	9.5	28027.9	431.6	4
	Qtr 2 2012	0.116	6.8	13.9	329.1	118.6	4.5
	Qtr 1 2012	0.071	6.8	16.9	20	7.9	11.8
WELL 15 D	Qtr 4 2012	0.033	7.5	8.5	87.9	145.3	2.8
	Qtr 3 2012	0.044	7.2	9.2	533.3	557.2	1.9
	Qtr 2 2012	0.081	7.9	9.1	82.9	171.3	3
	Qtr 1 2012	0.053	7.9	11.6	109.5	217	2.9
WELL 15 S	Qtr 4 2012	0.737	6	6.3	31091	522.9	2.9
	Qtr 3 2012	0.181	6.8	6.5	493.2	355.6	2.6
	Qtr 2 2012	0.8	6	38.4	8955	604.7	5.3
	Qtr 1 2012	0.762	6.1	12.7	27870	715	3.8
WELL 16 D	Qtr 4 2012	0.035	7.3	10.3	491.3	577.5	2.2
	Qtr 3 2012	0.042	7.9	5.2	20	98.6	2.4
	Qtr 2 2012	0.071	7.2	10	552	710.2	2.4
	Qtr 1 2012	0.052	7.3	13.5	438.9	1127	2.4
WELL 16 S	Qtr 4 2012	0.231	6.7	7.3	1290.6	406.5	2
	Qtr 3 2012	0.05	6.8	11.8	20	0.03	3.8
	Qtr 2 2012	0.466	6.8	8	2664	835.3	3.2
	Qtr 1 2012	0.249	6.9	10	224.4	324	3.3
Well 17 D	Qtr 4 2012	0.055	7.7	8.1	<20	479.3	3.1
Interim Guide Value		0.15	≥6.5 &≤9.5	30	200	50	5

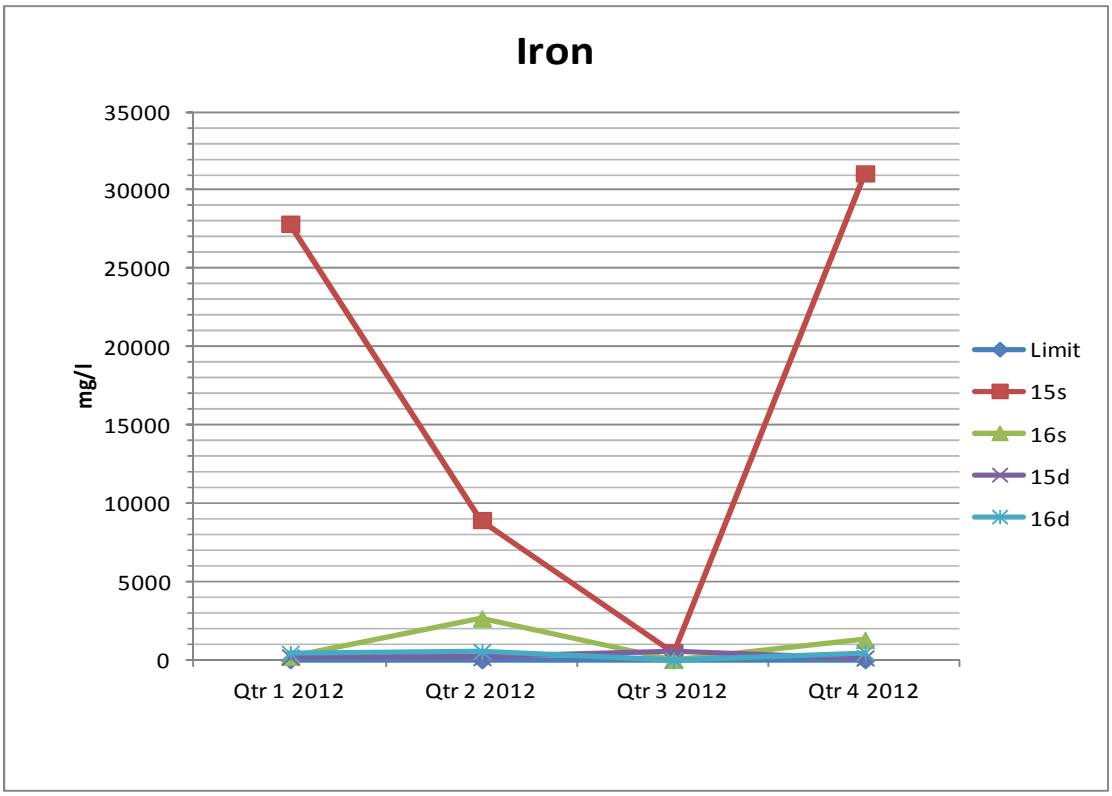
Graph 5.5



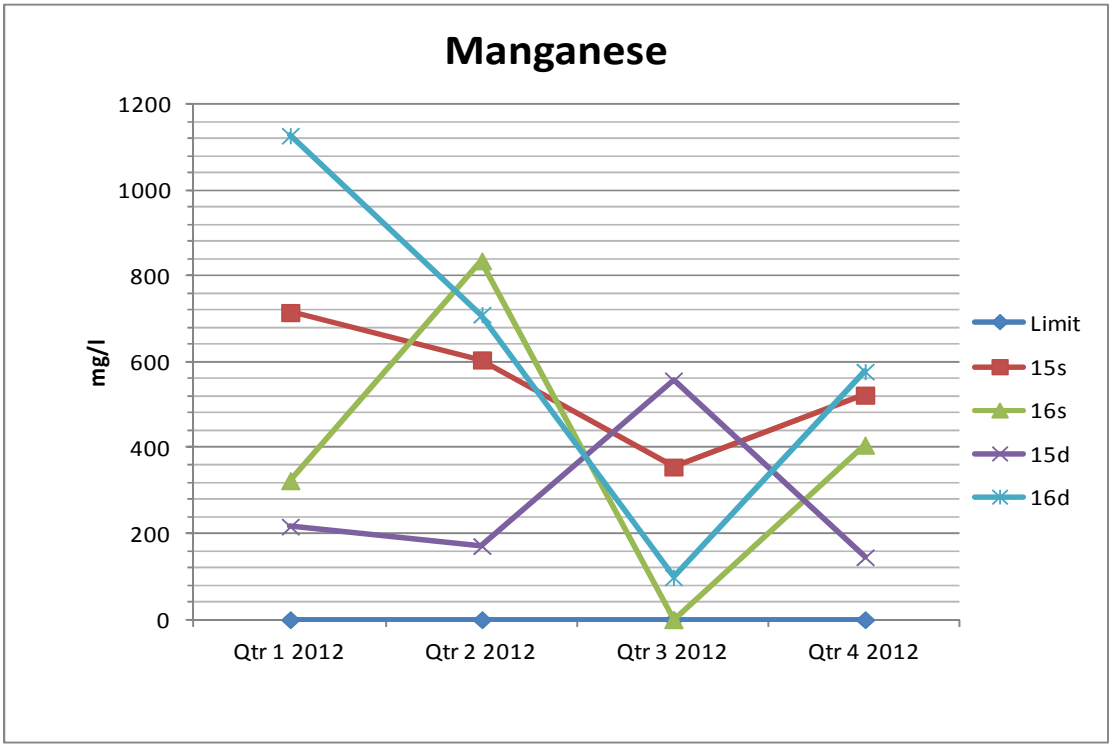
Graph 5.6



Graph 5.7



Graph 5.8



As detailed in the above graphs, there were numerous ground water exceedances in the vicinity of this landfill during 2012.

Exceedances occurred in the following parameters:

- Ammonia: Elevated levels of this parameter were prevalent during 2012. Elevated levels of ammonia are strongly associated with pollution from waste water treatment systems and so contamination of these wells by the landfill cannot be definitively concluded.
- Iron: Although increased Iron levels can be attributed to contamination from landfills, it is also strongly associated with the native soils of the Cavan area and therefore cannot be directly linked to the landfill.
- Chloride: This parameter is a strong indication of contamination from a landfill source.
- Manganese: Elevated levels of Manganese can be associated with landfill contamination but can also be attributed to the natural composition of the underlying soils.
- pH: Soils in this area are slightly acidic by nature and this is reflected in the monitoring results
- Potassium: Elevated levels of potassium can be associated with landfill contamination but it can also be associated with contamination from agricultural sources such as fertilizers. Therefore direct contamination from the landfill cannot be concluded.

5.3 Leachate Monitoring

Leachate monitoring is carried out annually in accordance with the licence.

Leachate samples were obtained from new leachate wells which were installed prior to quarter 4 monitoring 2012. A sample of leachate was also obtained from well MW9 during quarter 1 2012. There are no historic results or trends to display for the new wells for this reporting year.

Table 5.3 Leachate Summary Results

	Parameter	Ammonia	Cl	Cond
	Units	mg/l N	mg/l	us/cm
WELL MW 8	Qtr 4 2012	-	-	-
	Qtr 1 2012	-	-	-
	Qtr 4 2011	-	-	-
	Qtr 3 2011	-	-	-
WELL MW 9	Qtr 4 2012			
	Qtr 1 2012	<0.69	6.134	430
	Qtr 4 2011	-	-	-
	Qtr 3 2011	-	-	-
WELL MW 18	Qtr 4 2012	236	131.1	2965
WELL MW 19	Qtr 4 2012	6	<13	526
Interim Guide Values		0.15	200	1000

Monitoring of two new leachate wells begun in 2012 as per the waste licence.

5.4 Gas Emissions

Landfill gas monitoring is conducted at nine sampling locations. These locations are situated both inside and outside the landfill mass. Historic results for the period 2012 are displayed below.

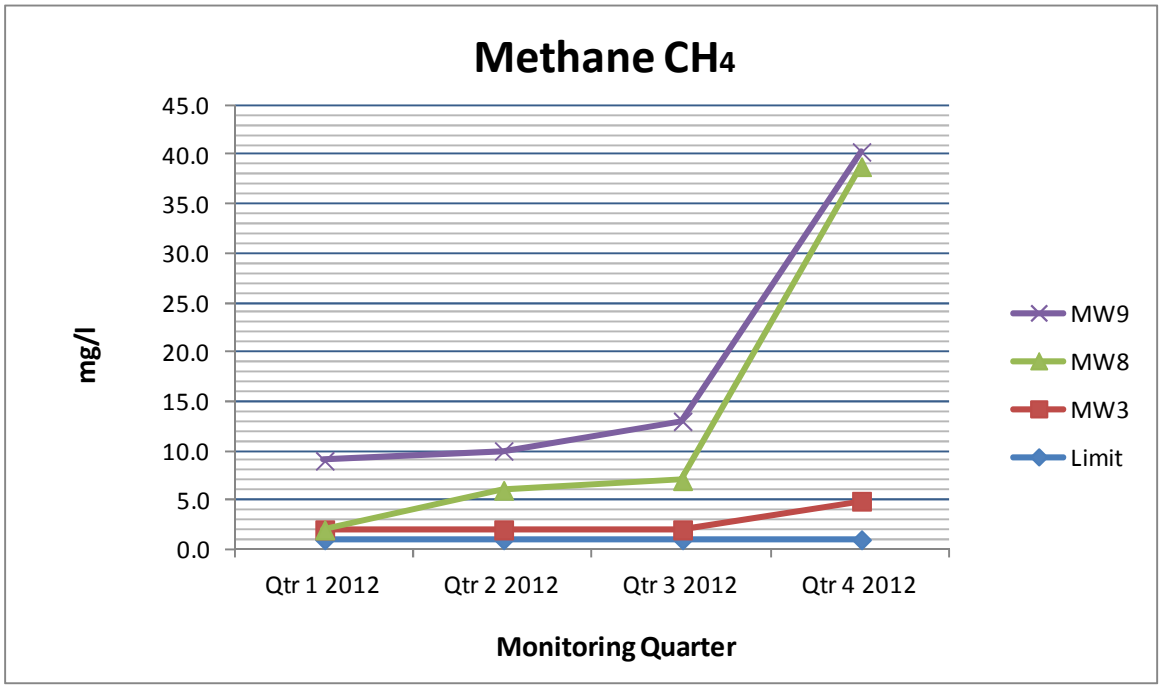
Table 5.4 Gas Emissions Summary

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		1% v/v	1.5 % v/v	%	PPM	mb
Client Ref	Qtr	-	-	-	-	-
MW 1	Qtr 4 2012	0	0	20.6	0	980
	Qtr 3 2012	0	0	21	0	993
	Qtr 2 2012	0	0	21	0	985
	Qtr 1 2012	0	0	21.4	0	1015
MW 2	Qtr 4 2012	0	0	20.9	0	980
	Qtr 3 2012	1	1	19	0	993
	Qtr 2 2012	1	1	21	0	985
	Qtr 1 2012	1	1	20.3	0	1014
MW 3	Qtr 4 2012	3.9	3.8	18.1	0	979
	Qtr 3 2012	1	2	18	0	993
	Qtr 2 2012	1	1	19	0	985
	Qtr 1 2012	1	1	20.3	0	1014
MW 6	Qtr 4 2012	0	1.5	18.7	0	979
	Qtr 3 2012	0	0	20	0	995
	Qtr 2 2012	0	0	21	0	985
	Qtr 1 2012	0	0	20.9	0	1014
MW 7	Qtr 4 2012	0.24	0.35	19.8	0	978
	Qtr 3 2012	0	0	20	0	985
	Qtr 2 2012	0	2	19	0	985
	Qtr 1 2012	0.4	1.7	18	0	1014
MW 8	Qtr 4 2012	33.9	31.1	0.25	0	979
	Qtr 3 2012	5	6	14	0	993
	Qtr 2 2012	4	5	14	0	985
	Qtr 1 2012	0	0	21.3	0	1014
MW 9	Qtr 4 2012	1.5	2.8	17	0	979
	Qtr 3 2012	6	3	19	0	995
	Qtr 2 2012	4	3	18	0	985
	Qtr 1 2012	7	7	13.8	0	1014
MW 10S	Qtr 4 2012	0	0.85	17.5	0	980
	Qtr 3 2012	0	0	20	0	993
	Qtr 2 2012	0	0	22	0	985
	Qtr 1 2012	0	0	20.9	0	1015
MW 10D	Qtr 4 2012	0	2.4	10.03	0	980
	Qtr 3 2012	0	1	15	0	993
	Qtr 2 2012	0	0	22	0	985
	Qtr 1 2012	0	0	21.7	0	1014
	Limit	**1**	**1.5**			
NOTES						
1	Instrument Serial No: GA 07721					
2	Limit: Schedule C2, Licence					
Exceedance						

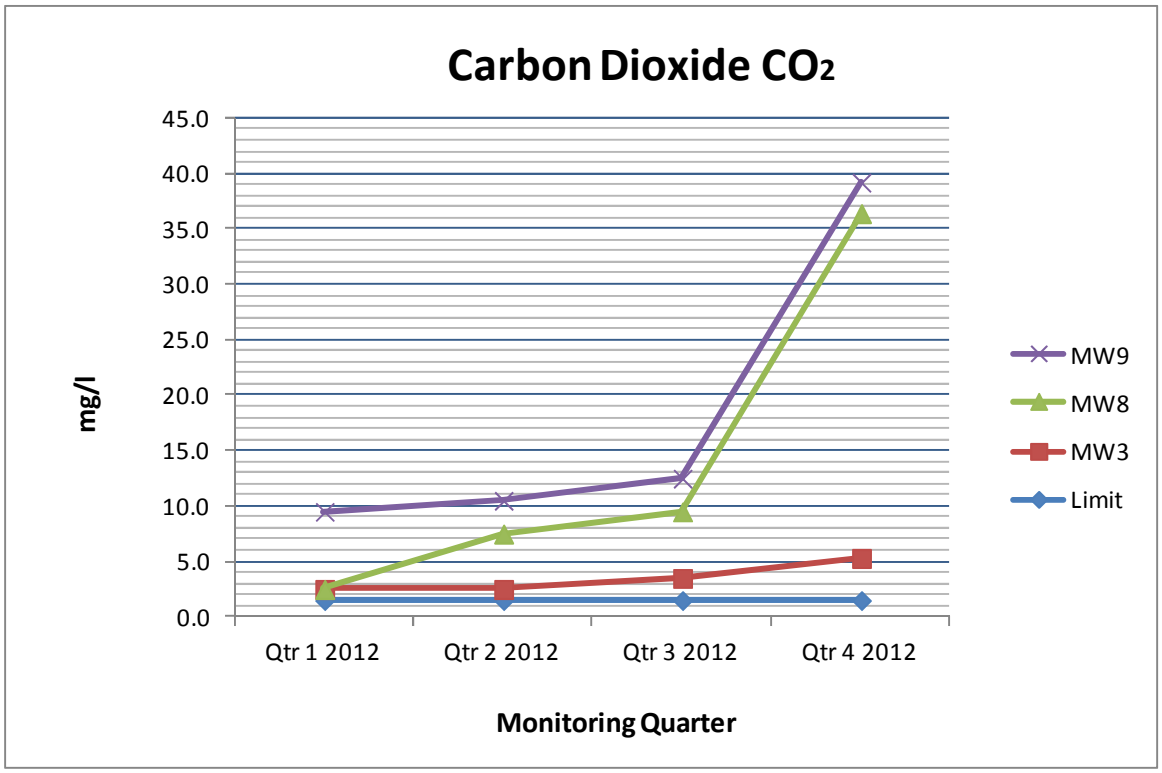
Results

The following graphs show gas monitoring results for 2012. These wells are located inside the waste mass.

Graph 5.9



Graph 6.0



Gas Monitoring on the site reveals typical low levels of Methane & Carbon Dioxide and higher levels of Oxygen. Minor elevations occurred in MW3, MW9, & MW8 - all located in the centre of the waste body. There was no significant gas migration recorded in monitoring wells outside of the waste body. The results are typical of a closed landfill.

6.0 SUMMARY OF RESULTS & INTERPRETATION OF ENVIRONMENTAL MONITORING

Included in Appendix C is a copy of the 4th quarter monitoring results as reported by Monitoring Company Boylan Engineering. We are satisfied that we are carrying out the environmental monitoring as specified in the Waste Licence. We are also satisfied that there are no major environmental impacts associated with this facility.

7.0 RESOURCE & ENERGY CONSUMPTION SUMMARY

As there is in-sufficient gas produced to run a gas flare or engine there is no use for the gas resource on site. There is no energy consumed on site.

8.0 REPORT ON RESTORATION OF THE FACILITY

The site is fully restored and the cap intact. There was some horse grazing on the site at various times during 2012. Gorse overgrowth has become prolific on the cap. Gorse was removed in early 2012 and re-growth will be monitored in 2013.

9.0 ESTIMATED ANNUAL & CUMULATIVE QUANTITIES OF LANDFILL GAS EMITTED FROM THE FACILITY

This information is reported in the PRTR Report attached in Appendix A. The estimated quantity of Methane released is 64100kgs/yr. Page one from the Annual Gas Survey is also presented in Appendix A.

10.0 FULL TITLE & WRITTEN SUMMARY OF ANY PROCEDURES DEVELOPED BY THE LICENSEE IN THE YEAR WHICH RELATES TOT HE FACILITY OPERATION

There was no change to or development of any procedures undertaken by the licensee or monitoring contractor in 2012. The environmental monitoring contractor 'Boylan Engineering' adhere to all standard practices for environmental monitoring.

11.0 REPORTED INCIDENTS & COMPLAINTS SUMMARY

There were no incidences in the reporting period 2012. There were no complaints received by the EPA or the Local Authority regarding this facility in the reporting period 2012.

12.0 REVIEW OF NUISANCE CONTROLS

As there are no known nuisances associated with this site there are no nuisance controls in place for noise or vermin. There is no odour detectable from the site and as these are the main nuisances associated with landfills the licensee has not reviewed the controls. This is substantiated by the absence of complaints regarding the facility. However, if any nuisances arise at the facility, the licensee will deal with them using appropriate measures and procedures.

13.0 REPORT ON TRAINING OF STAFF

Landfill Operations Manager Sinead Fox- for Cavan County Council deals with in full with any issues identified by the Agency Inspectors or any other party. Sinead has been fully trained in the control of landfill gas, the FAS Waste Management Training Course and carries a Safe Pass.

Table 13.1 Management Structure 2012

Position	Name	Duties
Director of Services Environment	Eoin Doyle	Oversee and assign responsibilities to staff regarding landfill
Senior Executive Officer	John Brannigan	Oversee general supervision, monitoring and reporting of the site.
Landfill Operations Manager	Sinead Fox	Responsible for general supervision, monitoring and reporting of the site.

Contact Person for Sanitary Authority for 2012/ 2013:

John Brannigan
Senior Executive Officer
Waste Management Section
Cavan County Council
Farnham Street,
Cavan

14.0 FINANCIAL PROVISION

Provision will be made in Cavan County Council Official Estimates for Charges as required under Condition 12 of Waste Licence Ref. 91-1.

15.0 ANY OTHER ITEMS AS SPECIFIED BY THE AGENCY

As requested by the Agency we have included in Appendix B a copy of the most recent Map of the site showing all Monitoring locations.

APPENDIX A

PRTR Emissions Report,

Landfill Gas Survey

Environmental Protection Agency

A survey of landfill sites to determine the quantity of methane flared and or recovered in utilisation plants for 2012

Please choose from the drop down menu the license number for your site	W0091
Please choose from the drop down menu the name of the landfill site	Bailieborough Landfill
Please enter the number of flares operational at your site in 2012	0
Please enter the number of engines operational at your site in 2012	0
Total methane flared	0 kg/year
Total methane utilised in engines	0 kg/year

Please note that the closing date for reciept of completed surveys is 31/03/2013

Introduction

The Office of Climate Licensing and Resource Use (OCLR) of the Environmental Protection Agency acts as the inventory agency in Ireland with responsibility for compiling and reporting national greenhouse gas inventories to the European Commission and the United Nations Framework Convention on Climate Change. In addition to meeting international commitments Ireland's national greenhouse gas inventory informs national agencies and Government departments as they face the challenge to curb emissions and meet Ireland's targets under the Kyoto Protocol. The national inventory also informs data suppliers, making them aware of the importance of their contributions to the inventory process and a means of identifying areas where input data may be improved.

It is on this basis that the Environmental Protection Agency is asking landfill operators to partake in this survey so that the most uptodate information on methane flaring and recovery in utilisation plants at landfills sites is used in calculating the contribution of the waste sector to national greenhouse gas emissions

The Environmental Protection Agency wishes to thank you for partaking in this survey. If you have any questions about the survey and how to complete it please view the "Help sheet" worksheet. If however, your query is not answered by viewing the "Help sheet" worksheet please contact:
LFGProject@epa.ie

Once completed please send the completed file as an attachment clearly stating the name and or license number of the landfill site (e.g. W000 Xanadu landfill_2012) to:
LFGProject@epa.ie

4.1 RELEASES TO AIR Link to previous years emissions data | PRTR# : W0091 | Facility Name : Bailieborough Landfill | Filename : W0091_2012.xls | Return Year : 2012 | 23/03/2013 13:07

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD				QUANTITY		
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
01	**Methane (CH4)**	C	MAB	GASSIM	0.0	64100.0	0.0	64100.0
03	Carbon dioxide (CO2)	C	MAB	GASSIM	0.0	180000.0	0.0	180000.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD				QUANTITY		
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD				QUANTITY		
			Method Used					
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

Additional Data Requested from Landfill operators

For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (CH4) emission to the environment under T(total) KG/yr for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Landfill: Bailieborough Landfill

Please enter summary data on the quantities of methane flared and / or utilised	**T (Total) kg/Year**	**M/C/E**	**Method Used**		**Facility Total Capacity m3 per hour**	
			Method Code	**Designation or Description**		
Total estimated methane generation (as per site model)	64100.0	C	MAB	GASSIM	N/A	
Methane flared	0.0				0.0	(Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	64100.0	C	MAB	GASSIM	N/A	

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.15

REFERENCE YEAR	2012

1. FACILITY IDENTIFICATION

Parent Company Name	Cavan County Council
Facility Name	Bailieborough Landfill
PRTR Identification Number	W0091
Licence Number	W0091-01

Waste or IPPC Classes of Activity

No.	class_name
3.1	Deposit on, in or under land (including landfill).
3.13	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.
4.11	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.2	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).
4.4	Recycling or reclamation of other inorganic materials.

Address 1	Tanderagee
Address 2	Bailieborough
Address 3	Co Cavan
Address 4	
	Cavan
Country	Ireland
Coordinates of Location	-6.97327 53.9092
River Basin District	IEEA
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Vincient Craig
AER Returns Contact Email Address	vcraig@cavancoco.ie
AER Returns Contact Position	Landfill Operations Manager
AER Returns Contact Telephone Number	049-4378410
AER Returns Contact Mobile Phone Number	
AER Returns Contact Fax Number	
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	1
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
5(c)	Installations for the disposal of non-hazardous waste
50.1	General

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

Is it applicable?	No
Have you been granted an exemption ?	No
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being used ?	

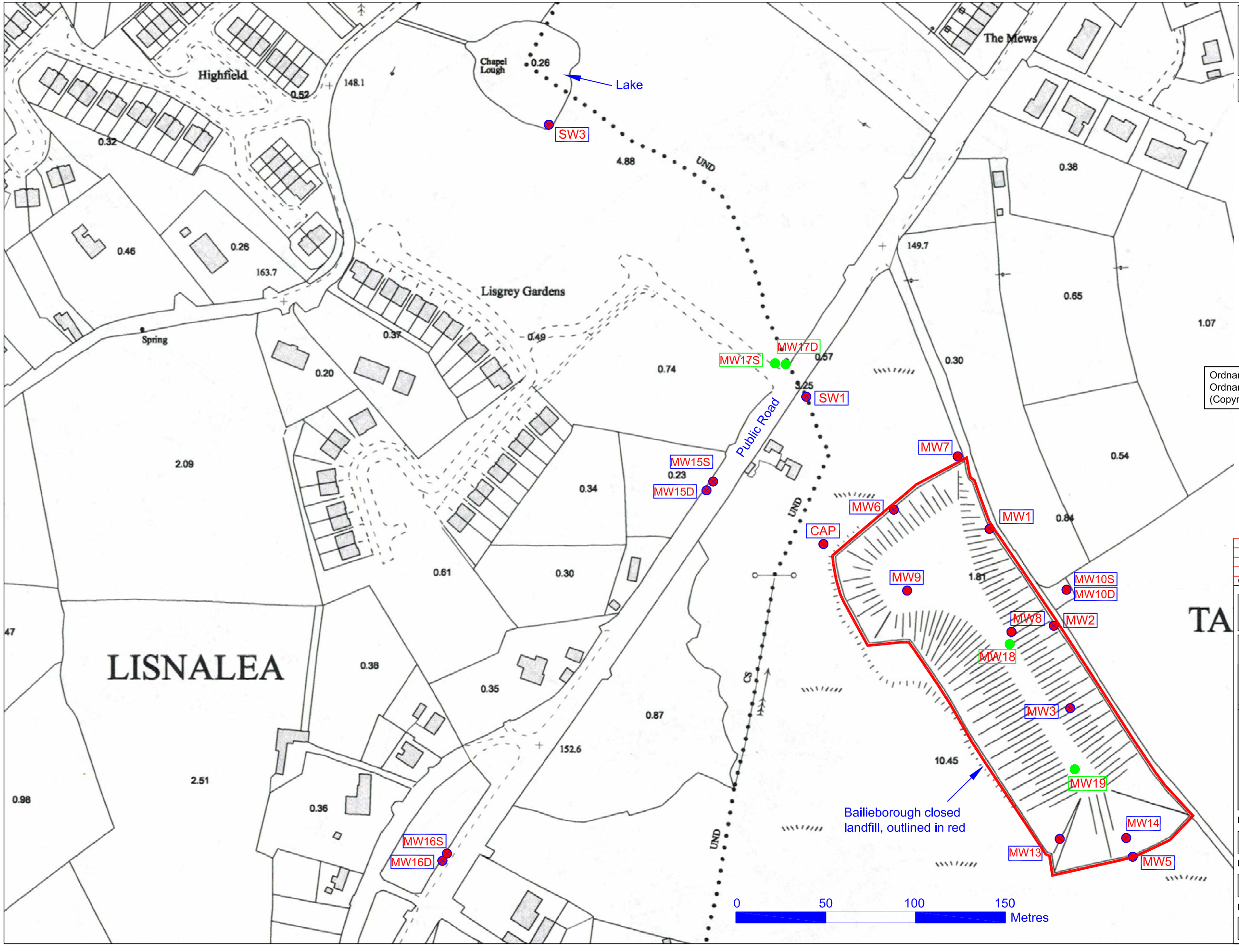
4. WASTE IMPORTED/ACCEPTED ONTO SITE Guidance on waste imported/accepted onto site

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	No

This question is only applicable if you are an IPPC or Quarry site

APPENDIX B

Site Map



Please Note
Do not scale from drawing.
All dimensions should be verified on site before construction and any discrepancies found brought to the attention of the Engineer.

All drawings remain the property of the Boylan Engineering, permission must be sought to copy any drawing or section there of.

NOTES / LEGEND

Rev.		
Rev. 1	01.11.12	Additional wells

Client: Cavan County Council

Project:
Bailieborough Landfill (WL91-01)

Boylan engineering
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Drawing No.	Drawing Name
001	Monitoring Well Locations

Date	Scale	Rev.
06.04.2012	1:2000	001

APPENDIX C
Q4 Monitoring Report

ENVIRONMENTAL MONITORING REPORT FOR BAILIEBOROUGH LANDFILL W0091-01

Client: **Cavan County Council**

Site Location: **Tanderagee, Bailieborough**

Report No.: CCC-02-01-02-04-Rev 0

Produced by: Brona Keating, BSc, P.Grad.Dip. Environmental Eng.

Approved by: **Date:** 30th November 2012

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Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out Environmental Monitoring at Bailieborough Landfill (W0091-01), Tandragee, Co Cavan for quarter four 2012.

Brona Keating, Environmental Consultant carried out all monitoring. This report shall document the findings.

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1. INTRODUCTION

Bailieborough landfill is situated approximately 1 kilometre from Bailieborough town centre in the townland of Tandergee. The site which comprises some 2.23 hectares was originally peat land which was stripped for commercial purposes. The site was then operated as a traditional landfill until its closure in 2002. A waste licence was issued by the Environmental Protection Agency after the closure of the site and remedial works were completed.

Condition 8.1 of the waste licence requires that monitoring be carried out in accordance with Schedule D of the licence. The following report give details of the groundwater, surface water and landfill gas sampling programme conducted on site and also summarises findings and analytical results for quarter four 2012.

The purpose of environmental and landfill gas monitoring at closed landfills is to:

- Ensure the facility is compliant with the waste license
- Ensure the facility is not causing environmental pollution
- Ensure the facility is not posing a risk to human health
- Ensure the facility is not creating an unacceptable risk to atmosphere, water, soil, plants or animals
- Ensure that the facility is not causing a nuisance through noise or odors
- Ensure the facility is not adversely affecting the countryside or places of interest
- Compare actual site behavior with expected/modeled behavior
- Assess the effectiveness of gas control measures installed at the site
- Establish a reliable database of information for the landfill throughout its life

According to the Response matrix for landfills, Bailieborough landfill is situated in the R2[1] Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R2[1] Zones are acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste licence - (EPA, groundwater protection Responses for Landfills). Unfortunately this landfill was constructed prior to this guidance and conditions were issued only after its closure.

Landfill gas is generated by decomposition of organic materials in waste deposited at landfills. Typically, the gas is a mixture of Methane (up to 65% by volume) Carbon Dioxide (up to 35% per volume). It can also contain minor constituents at low concentrations (typically less than 1% volume contains 120-150 trace constituents).
The landfill directive requires that appropriate measures are taken in order to control the accumulation and migration of landfill gas.

The generation of Leachate is one of the main hazards to groundwater from the disposal of waste by land filling. The conditions within a landfill vary over time from aerobic to anaerobic thus allowing for different chemical reactions to take place. Most landfill leachates have a high BOD, COD, Ammonia, Chloride, Sodium, Potassium, Hardness and Boron levels - (EPA, groundwater protection Responses for Landfills).

2. METHODOLOGY

2.1 Environmental Sampling

The following procedure is conducted by Boylan Engineering to ensure accurate groundwater, surface water and leachate monitoring:

- ISO 5667: Guidance on sampling of groundwaters is adhered to.
- Prior to sampling, the depth of water in groundwater wells is measured by dipping. Dipping the wells before sampling allows for calculation of the volume of water in the well. This data is recorded on the field sheet for volume calculation which is presented in appendix 4.
- Once the volume was calculated the boreholes are purged three times their volume before sampling.
- Sampling is conducted using a Waterra inertial lift pump and associated tubing, pumping water directly from the borehole to the appropriate sampling bottles.
- Designated tubing is used at each location.
- Surface water samples are taken by grab sample using a Telescoup and Pendulum beaker.
- Having obtained a representative sample the following parameters are measured on-site using a Hanna HI 98129 combination waterproof high accuracy analyser and a Hanna 9164 Dissolved Oxygen meter, respectively.
    - Conductivity
    - Temperature
    - pH
    - DO

- Boylan Engineering operate a Sample Submission/Chain of Custody form, which accompanies the samples at all times. These forms are located in the appendix 5.

2.2 Laboratory Analysis

- Samples are sent to Environmental Laboratory Service (ELS) (Ireland) for analysis of the required parameters in designated cool boxes with ice packs. These boxes insure that samples are maintained at a consistent temperature between 0 ^{o}C and 4^{o}C on their journey to the laboratory.
- On arrival at the laboratory, samples are stored between 0 ^{o}C and 4 ^{o}C.
- All samples received are inspected by Laboratory Manager Mr. Brendan Murray.
- All samples are assigned a unique reference number and are recorded on the Laboratory Information Management System (LIMS)
- All staff involved in the analysis of samples hold a minimum honours science degree.
- In the event of a Quality Control Check failure for a given parameter, a note will be included on the analysis report detailing the QC fail.
- Analysis of samples is conducted under the INAB accreditation and associated quality control procedures are employed in every aspect of analysis.
- Analysis methods are listed in Appendix 3.

2.3 Landfill Gas Analysis

The following procedure is employed by Brona Keating of Boylan Engineering to ensure accurate monitoring:

- EPA, Landfill Manual, landfill monitoring 2nd Edition is adhered to.
- Prior to sampling, a dip meter is used to measure water levels, if present, in the wells.
- GA 2000 landfill gas analyser is used to measure the gas levels.
- The analyser is purged and connected to the sealed well monitoring nozzle.
- The monitoring nozzle is turned to the open position and the analyser measured the gas levels at 60 second intervals for no less than 10 minutes. The analyser is allowed to run for this period of time to allow for a representative average to be obtained.
- All data is recorded on the Gas Analysis field sheet.
- The instrument is removed after 10 minutes and the monitoring nozzle returned to the closed position.
- The GA2000 is switched off between each monitoring location so as to allow the instrument to purge.
- This process is repeated at each monitoring location.
- Data for the GA 2000 was downloaded in the Boylan Engineering office.

2.4 Monitoring Locations

Quarter 4, 2012					
Monitoring Well	Sample Type	Cover Level M (OD Malin Head)	Water Level M (OD Malin Head)	Water Depth M (Top of Casing)	National Grid Co-Ordinates
MW1	GAS	151.55	-	-	N296071.96 E267506.68
MW2	GAS	152.72	-	-	N296018.08 E267540.57
MW3	GAS	159.27	-	-	N295972.19 E267549.66
MW6	GAS	150.27	-	-	N296082.66 E267451.47
MW8	Leachate	160.74	-	-	N296014.48 E267517.14
MW9	Leachate	157.94	-	-	N296037.63 E267458.87
MW10S	GAS	154.76	153.26	1.5	N296038.12 E267458.8
MW10D	GAS	154.76	149.16	5.6	N296038.12 E267458.87
MW15S	GW	150.36	148.54	1.82	N296097.36 E267343.36
MW15D	GW	150.39	148.79	1.6	N296092.30 E267344.88
MW16S	GW	152.6	151.12	1.48	N295888.86 E267202.87
MW16D	GW	152.53	151.36	1.17	N295885.59 E267200.97
MW17S	GW & GAS	149.58	-	Not accessible	N296179.25 E267321.30
MW17D	GW & GAS	149.49	148.14	1.35	N296178.68 E267327.22
MW18	Leachate & GAS	160.98	-	-	N296023.13 E267452.20
MW19	Leachate & GAS	162.12	-	-	N295954.06 E267499.79
SW1	SW	-	-	-	N296160.79 E267338.62
SW3	SW	-	-	-	N296312.44 E267195.10
CAP Discharge	SW	-	-	-	N296078.86 E267348.65

2.5 Weather Report

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall	Max	Min	Grass Min Temp	Mean Wind Speed	Gusts	Sunshine
	(mm)	Temp	Temp	(°C)	(knots)	(if >= 34 knots)	(hours)
		(°C)	(°C)				
16/10/2012	2.6	11.4	3.7	0.5	5.3		
*Met Eireann, Climate Data & reports, Daily Data							

3.0 SUMMARY OF RESULTS

3.1 Ground Water

Table 1.0 04th Quarter Ground water monitoring 2012

Report Number:	61117
Monitoring Date:	16.10.12

Method		Site Tests						TOC	Ammonia	AQ2-UP1	Titralab		Titralab	AQ2-UP2		DO	Total Cyanide High (Sub)	Total Phosphorus-TP	PhenolsTotal - Index (Sub1)
Method Number		Site Tests						DEFAULT	EW003	EW154M	EW153			EW154M		EW043	DEFAULT	EW146	DEFAULT
Parameter		Sample temperature (to be done onsite)	Cond	pH	DO	Water Level from TOC	Visual Inspection	TOC	Ammonia	TON (as N)(calc)	pH	Cond	Alkalinity Total (R2 pH4.5)	Chloride	Sulphate	Dissolved Oxygen	Total Cyanide High	Total Phosphorus-TP	Phenols-Total
Units		Deg C	us/cm	pH units	mg/l	Meter's	-	mg/l	mg/l N	mg/l N	pH Units	us/cm	mg/L CaCO3	mg/l	mg/l	mg/l	ug/L	mg/l P	mg/L
Limit of Detection		-	-	-	-	-	-	0.25	0.007	0.138	0.3	25	10	2.6	1.0	1.0	10	0.01	0.15
Date Testing Initiated		16.10.12						17.10.12											
ELS Ref	Client Ref																		
61117/005	MW10D	10.4	410	7.96	8	5.6	Clear	0.96	0.042	<0.138	7.9	408	155.8	5.7	56.4	7.9	<10	0.05	<0.15
61117/004	MW15S	11.8	209	6.88	5.4	1.82	Clear	12.58	0.737	0.15	6	210	63.2	6.3	31.7	5	<10	3.26	<0.15
61117/003	MW15D	10.3	314	7.95	7.1	1.6	Heavy Silt	0.53	0.033	<0.138	7.5	314	143.5	8.5	21.9	6.9	<10	0.34	<0.15
61117/002	MW16S	10.8	265	7.08	7.7	1.48	Clear	2.62	0.231	<0.138	6.7	262	116.4	7.3	24.8	7.6	<10	1.76	<0.15
61117/001	MW16D	10.5	270	7.30	5.3	1.17	Heavy Silt	1.05	0.035	<0.138	7.3	268	116	10.3	22.7	5.1	<10	0.1	<0.15
61117/006	MW17D	11.3	409	7.77	6.9	1.35	Clear	2.3	0.055	<0.138	7.7	409	173.6	8.1	43.9	6.8	<10	0.46	<0.15
IGV			1000	≥6.5 and ≤9.5				NAC	0.15	NAC	≥6.5 and ≤9.5	1000	NAC	30	200	NAC	10	-	-

Method		Coliforms	Coliforms	Ion Chromatography	Residue on Evaporation (Tot Solids-TS)	Metals-Total	Metals-Dissolved											
Method Number		MIC133		EW137	EW060	EM130												
Parameter		Total Coliforms	E. Coli	Fluoride	Residue on Evaporation (Tot Solids-TS)	Chromium-Total	Iron Dissolved	Manganese Dissolved	Potassium Dissolved	Sodium Dissolved	Cadmium-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved	Boron-Dissolved
Units		MPN/100ml	MPN/100ml	mg/L	mg/L	ug/L	ug/L	ug/L	mg/l	mg/l	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	mg/L
Limit of Detection		0		0.1	10.0	1.0	20.0	0.001	0.2	0.5	0.1	1.0	0.00	0.3		0.02	1.0	0.02
Date Testing Initiated		17.10.12																
ELS Ref	Client Ref																	
61117/005	MW10D	6	0	<0.1	<10	1	37.1	119.5	2.6	32.4	<0.1	33.8	<0.003	0.4	16.4	0.03	293.4	0.03
61117/004	MW15S	1218	126	<0.1	<10	165.7	31091	522.9	2.9	8.8	0.1	23.6	0.004	1	5.4	0.02	10.1	<0.02
61117/003	MW15D	520	132	0.13	<10	92.3	87.9	145.3	2.8	10.8	<0.1	32.9	<0.003	<0.3	13.2	0.03	11.5	0.02
61117/002	MW16S	63	41	0.21	<10	77	1290.6	406.5	2	9	0.1	23.6	<0.003	<0.3	14.6	0.03	11.1	<0.02
61117/001	MW16D	2	0	0.32	<10	<1	491.3	577.5	2.2	15.4	0.1	27.6	<0.003	<0.3	9.5	0.02	47.8	<0.02
61117/006	MW17D	408	74	0.11	<10	13.8	<20	479.3	3.1	14.4	0.1	51	<0.003	<0.3	17.2	0.02	11.3	0.02
IGV		0	0	1	-	30	200	50	5	150	0.005	200	0.03	10	50	1	100	1

Exceedance

NOTES

1 Sub-contract analysis denoted by *

2 ND - Concentration was below the limit of detection

3 NAC- No Abnormal Change

4 IGV - Interim Guide Value

As there are no limits set in the waste licence for groundwater, results are compared to the Interim Guide Values for the protection of Groundwater in Ireland, where available.

3.2 Surface Water

Table 2.0 04th Quarter Surface water monitoring 2012

Report Number		61116													
Monitoring Date		16/10/2012													
Method		**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**Ammonia**	**Titralab**			**5-Day**	**HACH**	**AQ2-UP2**		
Method Number		**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**EW154M**	**EW153**			**EW001**	**EW094**	**EW154M**		
Parameter		Sample temperature (to be done onsite)	Cond	pH	DO	Visual Inspection	Ammonia	pH	Alkalinity	Cond	BOD	COD	Cl	SO4	Phosphate - Ortho(as P)
Units		Deg C	us/cm	pH units	mg/l	-	mg/l N	pH Units	mg/L CaCO3	uscm-1@20	mg/l	mg/l	mg/l	mg/l	mg/l P
Limit of Detection		-	-	-	-	-	0.007	0.3	10	25	1	8	2.6	1.0	0.009
Date Testing Initiated		16.10.12					17.10.12								
ELS Ref	**Client Ref**														
61116/001	SW1	7.5	295	7.13	7.2	straw	1.409	7.1	288	120.5	<1	48	13.7	18.6	0.046
61116/002	SW3	8.9	281	7.17	5.7	straw	0.078	7.1	273	90.6	<1	38	13.1	22.6	<0.009
61116/003	CAP	9.5	310	7.31	9.2	clear	0.041	7.3	302	129.7	<1	22	5	27.8	0.02
S.I No. 294/1989							0.02	≥5.5 and ≤8.5	NAC	1000	5	40	250	200	-

Method		ICPMS				Metals Dissolved							Metals Total	AQ2-UP1	Inolab
Method Number		EM130												EW154M	EW043
Parameter		Iron-Dissolved	Manganese-Dissolved	Potassium-Dissolved	Sodium-Dissolved	Cadmium-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved	Chromium-Total	TON (as N)(Calc)	DO
Units		ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/l N	mg/l
Limit of Detection		20.000	1.0	0.2	0.5	0.1	1	20	0.3	0.3	0.02	1	1	0.138	1.0
Date Testing Initiated		17.10.12													
ELS Ref	Client Ref														
61116/001	SW1	741.6	258.9	6.8	14.4	0.1	37.8	<0.003	<0.3	8.1	0.04	7.9	<1	1.041	7
61116/002	SW3	222.6	53.5	6.2	13.8	<0.1	35	<0.003	<0.3	7.7	0.03	7.1	<1	0.837	5.5
61116/003	CAP	144.5	118.7	4.3	5.5	0.2	48.4	0.008	<0.3	7.1	0.03	37.9	<1	0.354	8.9
S.I No. 294/1989		200	50	-	-	5	-	0.03	10	-	1	100	30	-	-

Exceedance	
NOTES	
1	Sub-contract analysis denoted by *
2	ND - Concentration was below the limit of detection
3	NAC- No Abnormal Change

As there are no limits set in the waste licence for surface water, results are compared to S.I. No. 294/1989 — European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989.

3.3 Leachate

Table 3.0 04th Quarter Leachate monitoring 2012

Report Number: 61115

Monitoring Date: 16.10.12

Method		Site Tests	Ammonia	AQ2-UP1	Titralab		AQ2-UP2		5-Day	HACH	Coliforms		Ion Chromatography	AQ2-UP1
Method Number		**Site Tests**	**EW003**	**EW154M**	**EW153**		**EW154M-1**		**EW001**	**EW094**	MIC133		EW137	EW154M
Parameter		Visual Inspection	Ammonia	TON (as N)(calc)	pH	Cond	Sulphate	Cl	BOD	COD	E. Coli	Total Coliforms	Fluoride	Phosphate-Ortho(as P) (MRP)
Units		-	mg/l N	mg/l N	pH Units	us/cm	mg/L	mg/l	mg/l	mg/l	MPN/100 ml	MPN/100 ml	mg/L	mg/l P
Limit of Detection		-	0.035	0.69	0.3	25	5	13	1.0	8.0	10	10	0.1	0.045
Date Testing Initiated			17.10.12											
ELS Ref	**Client Ref**													
61115/001	MW18	Brown	236	<0.69	7	2965	34.8	131.1	27	1374	60	14540	<0.1	<0.045
61115/002	MW19	Brown	6	0.702	6.6	526	33.6	<13	25	1300	40	48393	0.41	<0.045
IGV			0.15	-	≥6.5 and ≤9.5	1000	200	30	200	NAC	0	0	1	-

Method		Total Cyanide High (Sub)	Total Phosphorus-TP	Metals-Total	Metals-Dissolved										
Method Number		DEFAULT	EW146	EM130											
Parameter		Total Cyanide High	Total Phosphorus-TP	Chromium-Total	Iron-Dissolved	Manganese-Dissolved	Potassium-Dissolved	Sodium-Dissolved	Cadmium-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved	Boron-Dissolved
Units		ug/L	mg/l P	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L
Limit of Detection		9	0.1	1	20	1	0.2	0.5	0.1	1	0.003	0.3	0.3	0.02	1	0.02
Date Testing		17.10.12														
ELS Ref	Client Ref															
61115/001	MW18	11	3.99	105.3	450.3	44.1	112.4	171.5	0.2	45.3	<0.003	<0.3	79.9	<0.02	3.6	1.22
61115/002	MW19	<9	5.54	218.6	43258.9	1351.3	9.2	15.5	0.2	89.7	<0.003	2.3	14	<0.02	19.5	0.09
IGV		10	-	30	200	50	5	150	0.005	200	0.03	10	50	1	100	1

Exceedance	
NOTES	
1	Sub-contract analysis denoted by *
2	ND - Concentration was below the limit of detection
3	NAC- No Abnormal Change

As there are no limits set in the waste licence for leachate, results are compared to the Interim Guide Values for the protection of Groundwater in Ireland, where available.

3.4 Landfill Gas Summery

Table 4.0 04th Quarter Landfill Gas monitoring 2012

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000	
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure	Position to waste mass
Units		% v/v	% v/v	%	PPM	mb	
Date Testing		16/10					
GA 2000 Ref	Client Ref						
7	MW 1	0	0	20.6	0	980	Outside
8	MW 2	0	0	20.9	0	980	Outside
11	MW 3	3.9	3.8	18.1	0	979	Inside
3	MW 6	0	1.5	18.7	0	979	Outside
13	MW 7	0.24	0.35	19.8	0	978	Outside
9	MW 8	33.9	31.1	0.25	0	979	Inside
4	MW 9	1.5	2.8	17	0	979	Inside
1	MW 10 S	0	0.85	17.5	0	980	Outside
2	MW 10 D	0	2.4	10.03	0	980	Outside
6	MW17S	0	0.17	20	0	980	Outside
5	MW17D	0	0	20.5	0	980	Outside
10	MW18	63.1	33.3	0	0	978	Inside
12	MW19	38.9	24.8	0	0	978	Inside
	Limit	1	1.5				

Exceedance,outside waste mass

NOTES

1 Instrument Serial No: GA 07721

2 Limit: Schedule C2, Licence

4.0 DISCUSSION

4.1 Ground water

Monitoring of groundwater is a common and necessary event in landfill sites both during their active life and post closure. The significance of such monitoring is so the facilities can demonstrate that there is no potential for the migration of hazardous constituents from the unit into the groundwater systems.

Monitoring was conducted on the 16th October 2012. Results in Hatched Red indicate where the interim guide value has been exceeded. Results from Quarter four 2012 show that there were exceedances at various ground water monitoring locations for parameters; Ammonia, pH, Total Coliforms, E-Coli, Chromium, Iron, Manganese and Zinc. Previous results detailed in the historical data show that exceedances for Ammonia, Iron and Manganese are on par with previous monitoring events. The exceedance in pH has been noted at location MW 15S on previous monitoring events. The presence of E-coli and Total Coliforms may be attributed to runoff from the adjacent agricultural field up gradient of the well. There were numerous farm animals present in this field on the day of monitoring.

A sample was taken from the new deep groundwater well (MW17D) situated down gradient of the landfill. A sample could not be obtained from the shallow well (MW17S) due to access. This issue has since been addressed and a sample will be taken in December and results will be submitted in the Quarter 1 2013 report. Results from the deep well sample were within the Interim Guide Values with the exception of Total Coliforms, E-Coli which is attributed to contamination from the well boring machinery and Manganese which is attributed to the natural composition of the surrounding soils.

Elevated Iron levels at the remaining wells can be an indication of contamination. However, the hypothesis that is proposed is that the source of this Iron is not the landfill leachate, but the native soils beneath the landfill. Iron can become mobilised due to changing pH and/or redox conditions in the environment underneath the landfill. Alternatively, the Leachate from

the non hazardous waste may produce reducing conditions beneath the landfill, allowing the solution of Iron and Manganese from the underlying deposits. Elevated Iron may also be attributed to the natural composition of this area.

Historical results for comparison purposes are presented in tabular and graphic form in Appendix 1.

4.2 Surface Water

As there are no limits set in the waste license for surface water, results are compared to the S.I. No. 294/1989 — European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989 where available.

Surface water samples were taken at SW1 (downstream of landfill) and at SW3 which is a new location at Chapel Lough as agreed with the EPA on the 04th April 2011, letter reference: W0091-01/ap05em. A sample was also taken from the discharge cap on the North West Boundary of the facility.

With regard to all surface water samples, results in hatched red indicate that limits were exceeded for the following parameters: Ammonia, COD, Iron and Manganese. Previous results detailed in the historical data show that exceedances for each of these parameters is on par with previous monitoring events.
Historical results for comparison purposes are presented in tabular and graphic form in Appendix 1.

4.3 Leachate

Leachate samples were taken from wells MW18 and MW19 which were installed in August 2012. The new wells were installed to replace wells MW8 and MW9 which had become inaccessible due to the movement of the landfill.

As there are no limits set in the waste license for leachate, results are compared to the Interim Guide Values for the protection of Groundwater in Ireland, where available. Results obtained show exceedances in terms of the Interim Guide Value for the following parameters: Ammonia, Conductivity, Chloride, E-coli, Total Coliforms, Cyanide, Chromium, Iron Potassium, Magnesium and Boron.

As these results are the first obtained from the new wells there are no comparative figures available and as such, conclusive summations therefore cannot be made.

Sampling will take place again in quarter 1 2013 at which time a more comprehensive study of parameters will be conducted.

4.4 Landfill Gas

The rate of gas generation at a landfill site varies through the life of a landfill and is dependent on several factors such as waste type, depths, moisture content, degree of compaction, landfill pH, temperature and the length of time since the waste was deposited. Landfill gas can move in any direction within the waste body and migrate from a site. The potential for gas migration will depend on the gas quality, volume, the site engineering works, geological characteristics of the surrounding strata and on man-made pathways such as sewers and drains.

Results obtained from monitoring during quarter four, 2012 show that the levels of gas are relatively consistent with previous results in all existing wells. Results obtained from new wells MW18 and MW19 which are within the waste mass were elevated for Methane and Carbon Dioxide. It is recommended that further gas monitoring is conducted for comparison purposes. Gas analysis of the new wells outside of the waste mass revealed that they did not contain Methane.

5.0 CONCLUSION

5.1 Environmental Monitoring

The results obtained from environmental monitoring are relatively consistent with previous monitoring events. The levels of exceeded parameters do not show any signs of dramatic exceedences therefore there is no evidence of any major negative environmental impact associated with this landfill.

5.2 Landfill Gas Monitoring

The results obtained from landfill gas analysis are also relatively consistent with previous monitoring events and do not show any signs of dramatic exceedances; therefore there is no evidence of any major negative environmental impact associated with this landfill. However, it is important to monitor the trend in exceedance of Methane at this landfill and any dramatic increase in the parameter should be regarded as critical. The Methane content of landfill gas is flammable, forming potentially explosive mixtures in certain conditions, which raises concern about its uncontrolled migration and release. The next environmental and landfill gas monitoring will be conducted in the 1st quarter of 2013.

APPENDIX 1 HISTORICAL DATA

Groundwater

	Parameter	TOC	Ammonia	TON	pH	Cond	Cl	SO4	DO	Fe	Mn	K	Na
	Units	mg/l	mg/l N	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	ug/l	mg/l	mg/l
WELL 10 D	Qtr 4 2012	0.96	0.042	<0.138	7.9	408	5.7	56.4	7.9	37.1	119.5	2.6	32.4
	Qtr 3 2012	1.09	0.052	<0.138	8	300	8.6	24.1	9	69.7	137.9	2.7	10.6
	Qtr 2 2012	11.97	0.8	<0.138	6	252	38.4	32.7	3.9	8955	604.7	5.3	18.8
	Qtr 1 2012	0.73	0.037	<0.138	7.9	407	9.2	67.2	7	20	100	2.9	30.9
WELL 10 S	Qtr 4 2012	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 3 2012	11.69	0.749	0.176	5.9	189	9.5	53.3	5.5	28027.9	431.6	4	9.8
	Qtr 2 2012	5.68	0.116	<0.138	6.8	309	13.9	10.1	6.7	329.1	118.6	4.5	17.4
	Qtr 1 2012	1.4	0.071	<0.138	6.8	296	16.9	12.3	8.6	20	7.9	11.8	23.9
WELL 15 D	Qtr 4 2012	0.53	0.033	<0.138	7.5	314	8.5	21.9	6.9	87.9	145.3	2.8	10.8
	Qtr 3 2012	0.5	0.044	<0.138	7.2	268	9.2	23.6	4.8	533.3	557.2	1.9	14.6
	Qtr 2 2012	2.15	0.081	<0.138	7.9	286	9.1	15.1	9.1	82.9	171.3	3	12.2
	Qtr 1 2012	0.87	0.053	<0.138	7.9	290	11.6	23.9	8.5	109.5	217	2.9	10.9
WELL 15 S	Qtr 4 2012	12.58	0.737	0.15	6	210	6.3	31.7	5	31091	522.9	2.9	8.8
	Qtr 3 2012	1.99	0.181	<0.138	6.8	258	6.5	25.6	8.6	493.2	355.6	2.6	8.8
	Qtr 2 2012	11.97	0.8	<0.138	6	252	38.4	32.7	3.9	8955	604.7	5.3	18.8
	Qtr 1 2012	11.01	0.762	0.15	6.1	198	12.7	39.7	1.4	27870	715	3.8	8.5
WELL 16 D	Qtr 4 2012	1.05	0.035	<0.138	7.3	268	10.3	22.7	5.1	491.3	577.5	2.2	15.4
	Qtr 3 2012	0.68	0.042	<0.138	7.9	409	5.2	64.6	6.5	20	98.6	2.4	32.5
	Qtr 2 2012	2.89	0.071	<0.138	7.2	258	10	19.6	4.9	552	710.2	2.4	17.7
	Qtr 1 2012	0.69	0.052	<0.138	7.3	261	13.5	24.4	6	438.9	1127	2.4	15.6
WELL 16 S	Qtr 4 2012	2.62	0.231	<0.138	6.7	262	7.3	24.8	7.6	1290.6	406.5	2	9
	Qtr 3 2012	1.53	0.05	<0.138	6.8	311	11.8	8.2	7.4	20	0.03	3.8	14.4
	Qtr 2 2012	4.04	0.466	<0.138	6.8	275	8	21.4	4.2	2664	835.3	3.2	10.7
	Qtr 1 2012	2.05	0.249	<0.138	6.9	240	10	27.8	6.5	224.4	324	3.3	8.2
Well 17 D	Qtr 4 2012	2.3	0.055	<0.138	7.7	409	8.1	43.9	6.8	<20	479.3	3.1	14.4
Interim Guide Value		NAC	0.15	NAC	≥6.5 &≤9.5	1000	30	200	NAC	200	50	5	150

Surface water

	Parameter	Ammonia	pH	Cond	BOD	COD	Cl	SO4	Ortho-Phosphate (MRP)	DO	Fe	Mn	K	Na
	Units	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l P	mg/l	ug/l	ug/l	mg/l	mg/l
Discharge Cap	Qtr 4 2012	0.041	7.3	129.7	<1	22	5	27.8	0.02	8.9	145	119	4.3	5.5
	Qtr 3 2012	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 2 2012	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 1 2012	-	-	-	-	-	-	-	-	-	-	-	-	-
SW1	Qtr 4 2012	1.409	7.1	120.5	<1	48	13.7	18.6	0.046	7	742	259	6.8	14.4
	Qtr 3 2012	1.936	7	323	<1.0	68	15.6	11.8	0.127	3.1	4114	1121	7.2	14.6
	Qtr 2 2012	0.565	7.2	292	<1.0	49	25.4	10.3	0.034	5.6	704	354	8	19.5
	Qtr 1 2012	0.897	7.1	298	<1.0	31	26	29.9	0.016	6.4	529	273	7.3	15.1
SW3	Qtr 4 2012	0.078	7.1	90.6	<1	38	13.1	22.6	<0.009	5.5	223	54	6.2	13.8
	Qtr 3 2012	1.011	7.1	315	3	55	12.9	20.3	<0.009	6.1	1239	2180	6.2	14
	Qtr 2 2012	0.019	7.2	292	<1.0	37	19.2	30.4	<0.009	10.1	1085	757	3.6	15.3
	Qtr 1 2012	0.15	6.9	297	<1.0	21	25.4	46.5	0.012	7.8	287	872	5.8	16.1
S.I No 294/1989		0.2	≥5.5 and ≤8.5	1000	5	40	250	200		NAC	200	50		

Leachate

	Parameter	Ammonia	Cl	TON	SO4	Cond	pH	COD	BOD
	Units	mg/l N	mg/l	mg/l N	mg/l	us/cm	pH Units	mg/l	mg/l
WELL MW 8	Qtr 4 2012	-	-	-	-	-	-	-	-
	Qtr 1 2012	-	-	-	-	-	-	-	-
	Qtr 4 2011	-	-	-	-	-	-	-	-
	Qtr 3 2011	-	-	-	-	-	-	-	-
WELL MW 9	Qtr 4 2012	<0.69	6.134	<0.69	6.8	430	<13.0	26	157
	Qtr 1 2012	<0.69	6.134	<0.69	6.8	430	<13.0	26	157
	Qtr 4 2011	-	-	-	-	-	-	-	-
	Qtr 3 2011	-	-	-	-	-	-	-	-
WELL MW 18	Qtr 4 2012	236	131.1	<0.69	34.8	2965	7	1374	27
WELL MW 19	Qtr 4 2012	6	<13	0.702	33.6	526	6.6	1300	25
Interim Guide Values		0.15	200	NAC	200	1000	≥6.5&≤9.5		

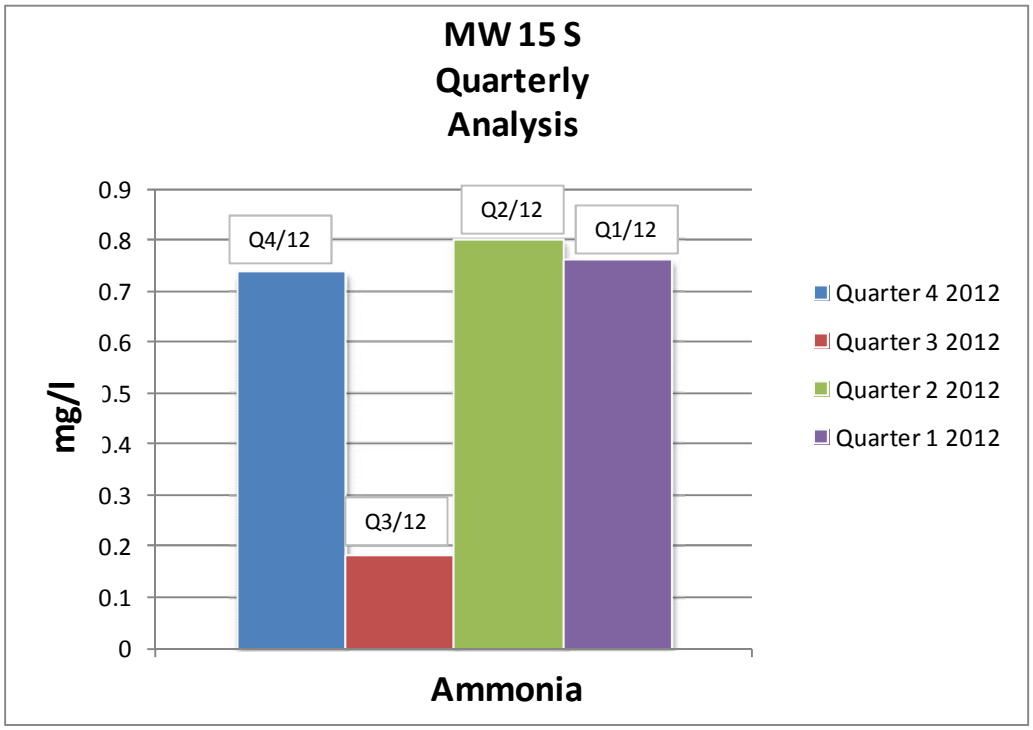
Landfill Gas

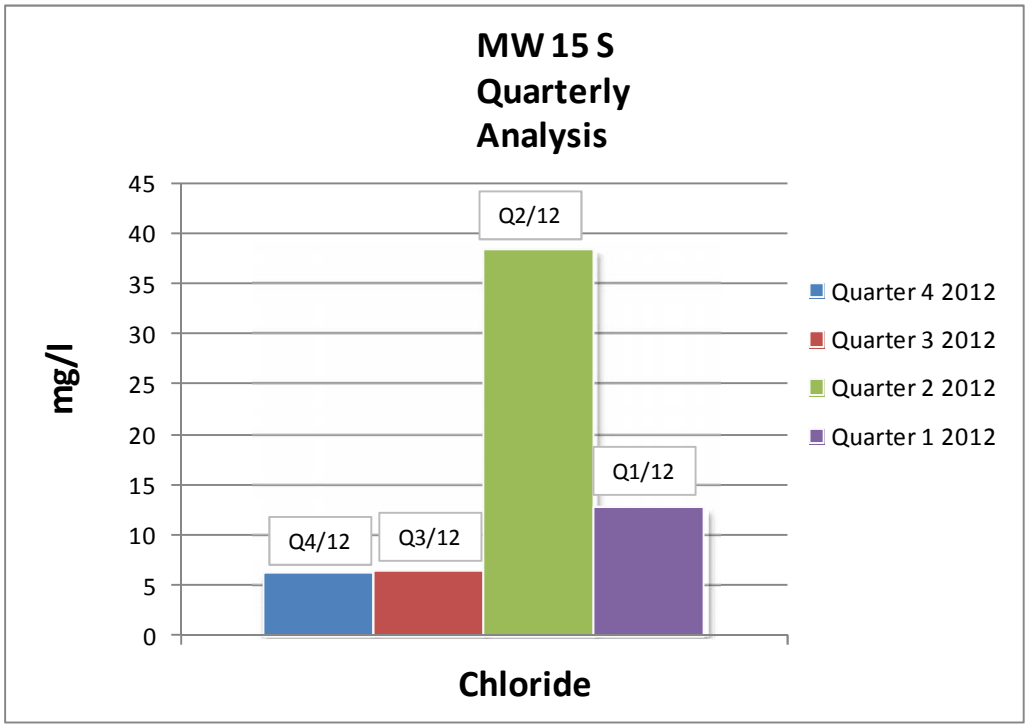
Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		1% v/v	1.5 % v/v	%	PPM	mb
Client Ref	Qtr	-	-	-	-	-
MW 1	Qtr 4 2012	0	0	20.6	0	980
	Qtr 3 2012	0	0	21	0	993
	Qtr 2 2012	0	0	21	0	985
	Qtr 1 2012	0	0	21.4	0	1015
MW 2	Qtr 4 2012	0	0	20.9	0	980
	Qtr 3 2012	1	1	19	0	993
	Qtr 2 2012	1	1	21	0	985
	Qtr 1 2012	1	1	20.3	0	1014
MW 3	Qtr 4 2012	3.9	3.8	18.1	0	979
	Qtr 3 2012	1	2	18	0	993
	Qtr 2 2012	1	1	19	0	985
	Qtr 1 2012	1	1	20.3	0	1014
MW 6	Qtr 4 2012	0	1.5	18.7	0	979
	Qtr 3 2012	0	0	20	0	995
	Qtr 2 2012	0	0	21	0	985
	Qtr 1 2012	0	0	20.9	0	1014
MW 7	Qtr 4 2012	0.24	0.35	19.8	0	978
	Qtr 3 2012	0	0	20	0	985
	Qtr 2 2012	0	2	19	0	985
	Qtr 1 2012	0.4	1.7	18	0	1014
MW 8	Qtr 4 2012	33.9	31.1	0.25	0	979
	Qtr 3 2012	5	6	14	0	993
	Qtr 2 2012	4	5	14	0	985
	Qtr 1 2012	0	0	21.3	0	1014
MW 9	Qtr 4 2012	1.5	2.8	17	0	979
	Qtr 3 2012	6	3	19	0	995
	Qtr 2 2012	4	3	18	0	985
	Qtr 1 2012	7	7	13.8	0	1014
MW 10S	Qtr 4 2012	0	0.85	17.5	0	980
	Qtr 3 2012	0	0	20	0	993
	Qtr 2 2012	0	0	22	0	985
	Qtr 1 2012	0	0	20.9	0	1015
MW 10D	Qtr 4 2012	0	2.4	10.03	0	980
	Qtr 3 2012	0	1	15	0	993
	Qtr 2 2012	0	0	22	0	985
	Qtr 1 2012	0	0	21.7	0	1014
	Limit	**1**	**1.5**			

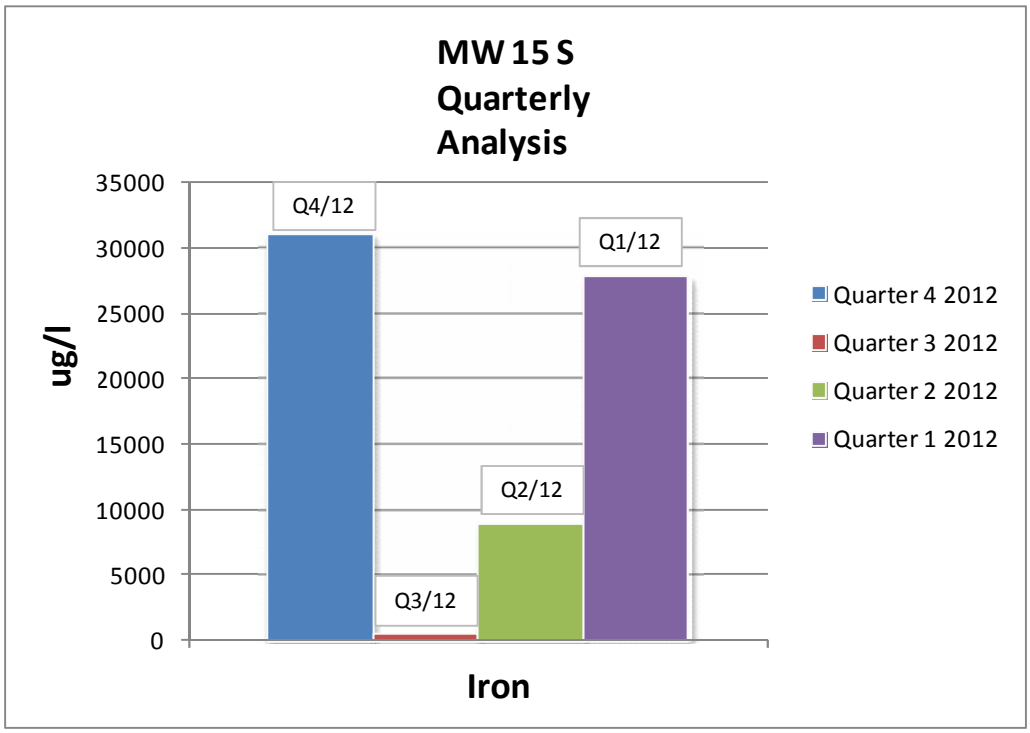
NOTES	
1	Instrument Serial No: GA 07721
2	Limit: Schedule C2, Licence
Exceedance	

HISTORICAL DATA

Groundwater



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ug/l
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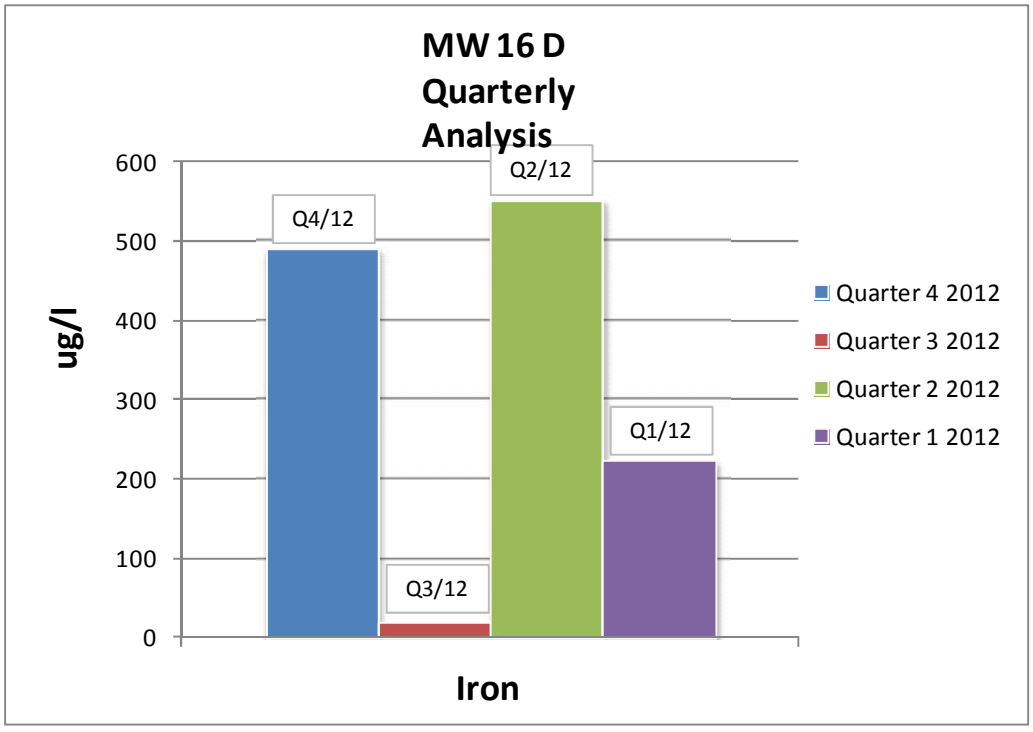
Q2/12
Q1/12
Iron
Quarter 4 2012
Quarter 3 2012
Quarter 2 2012
Quarter 1 2012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500
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200
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Q3/12
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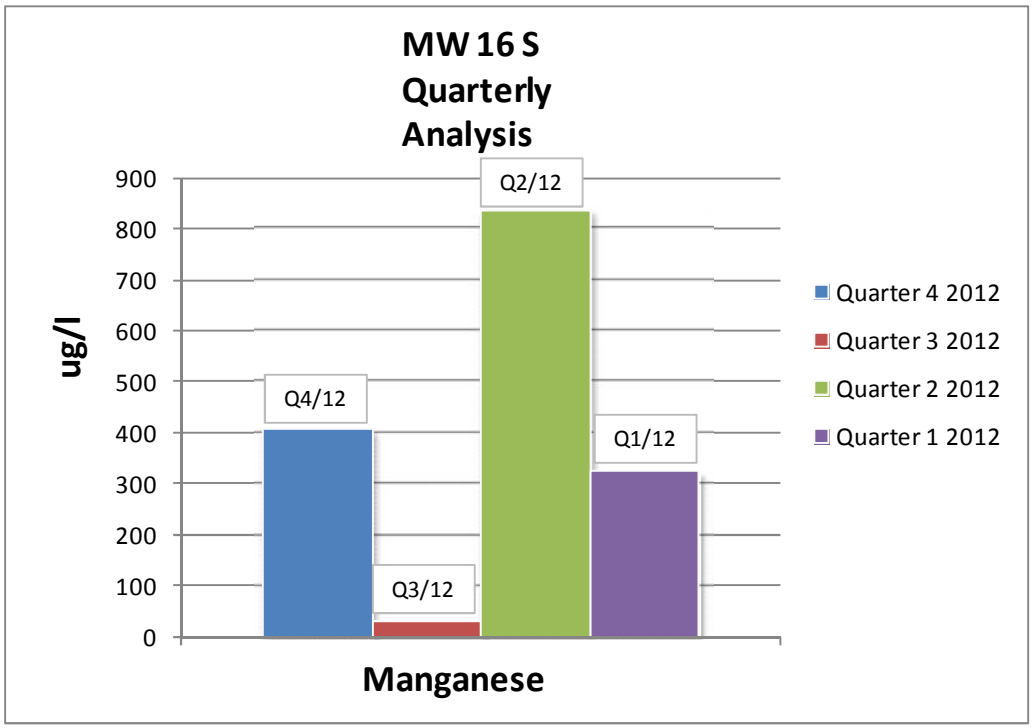
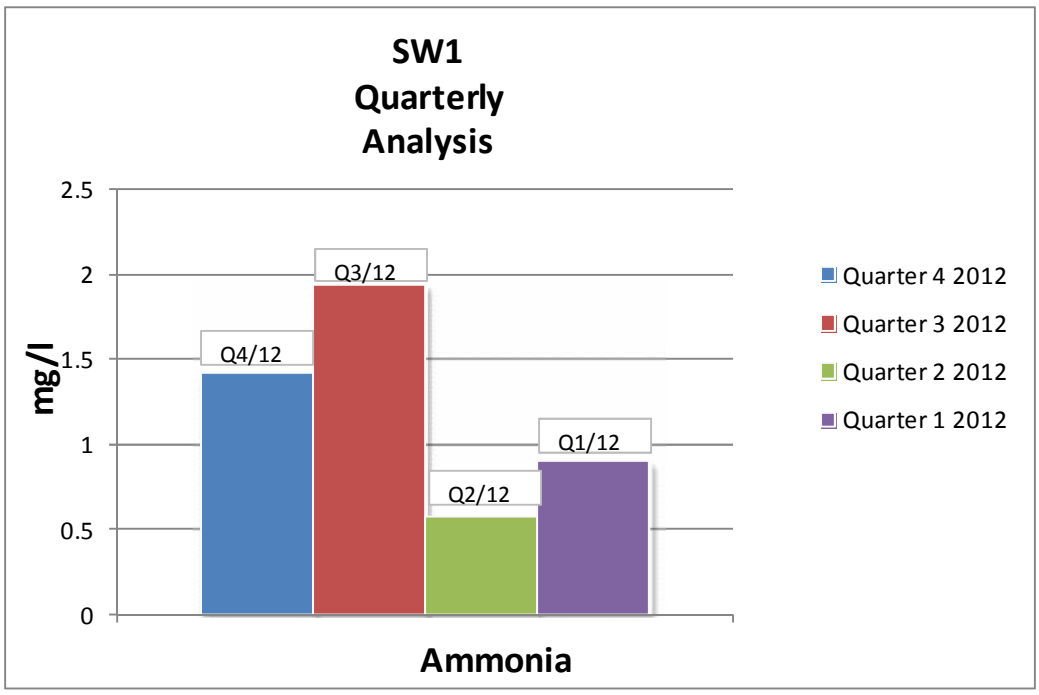
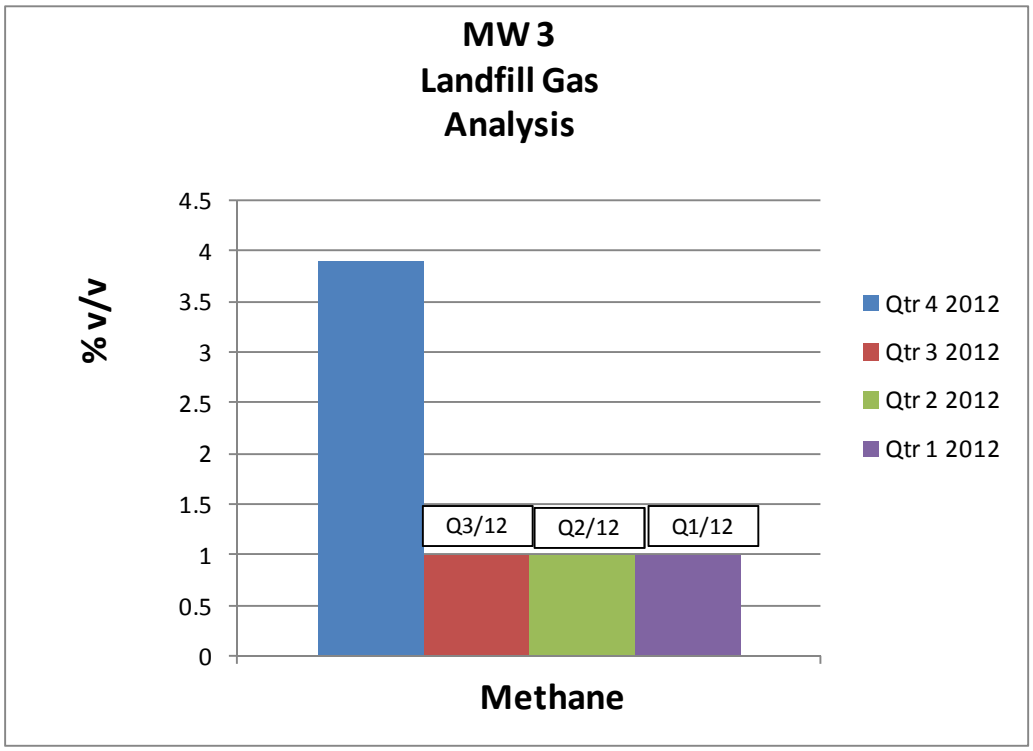
Q1/12
Iron
Quarter 4 2012
Quarter 3 2012
Quarter 2 2012
Quarter 1 2012

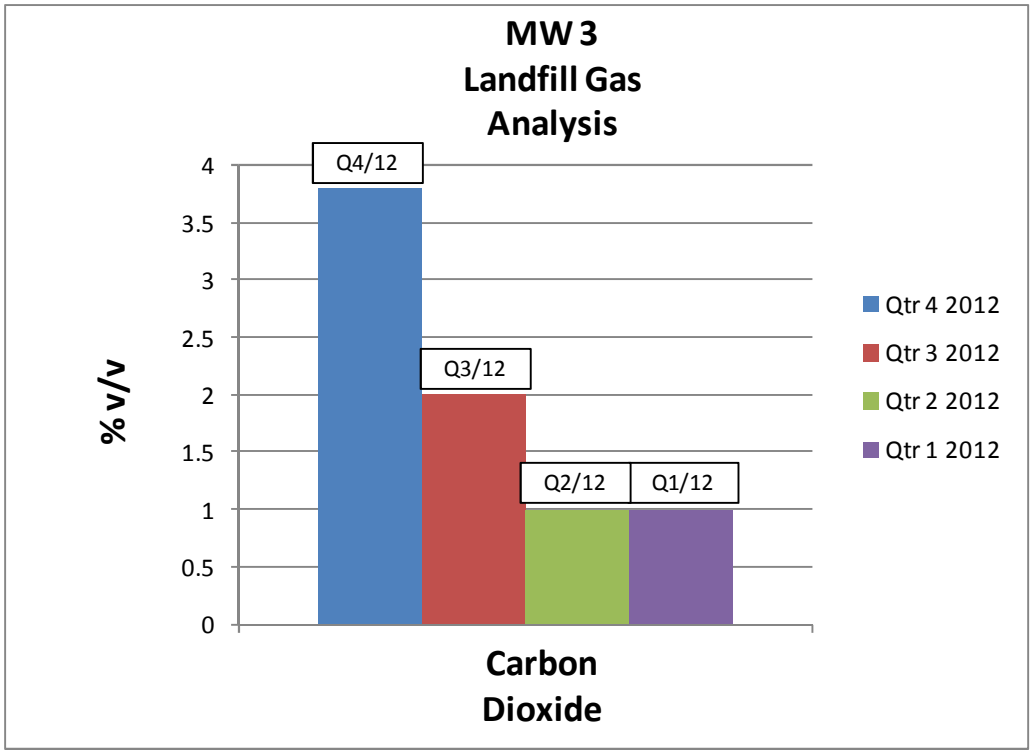


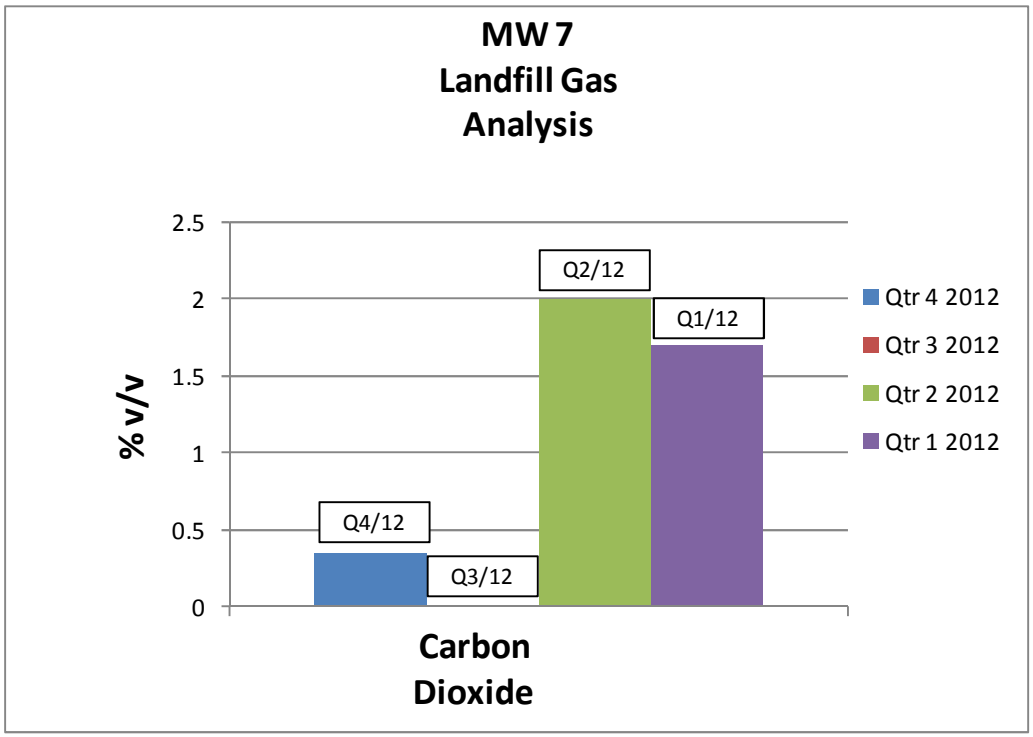
Surface water



Landfill Gas



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2
1.5
1
0.5
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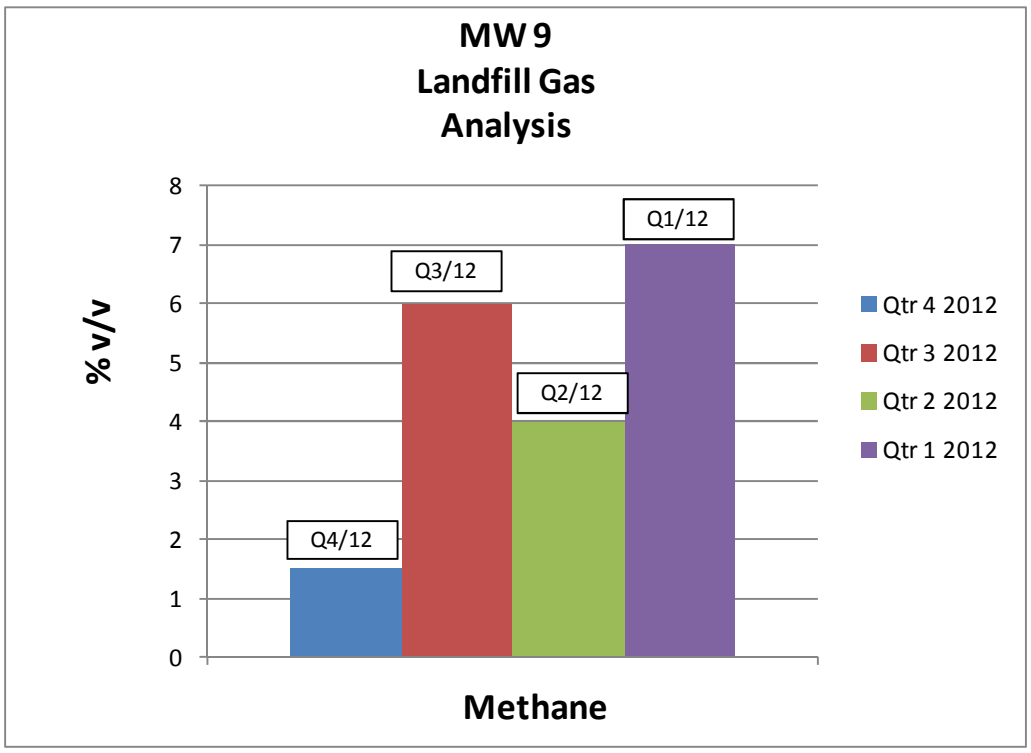
% v/v
Q2/12
Q1/12
Q4/12
Q3/12
Qtr 4 2012
Qtr 3 2012
Qtr 2 2012
Qtr 1 2012
Carbon
Dioxide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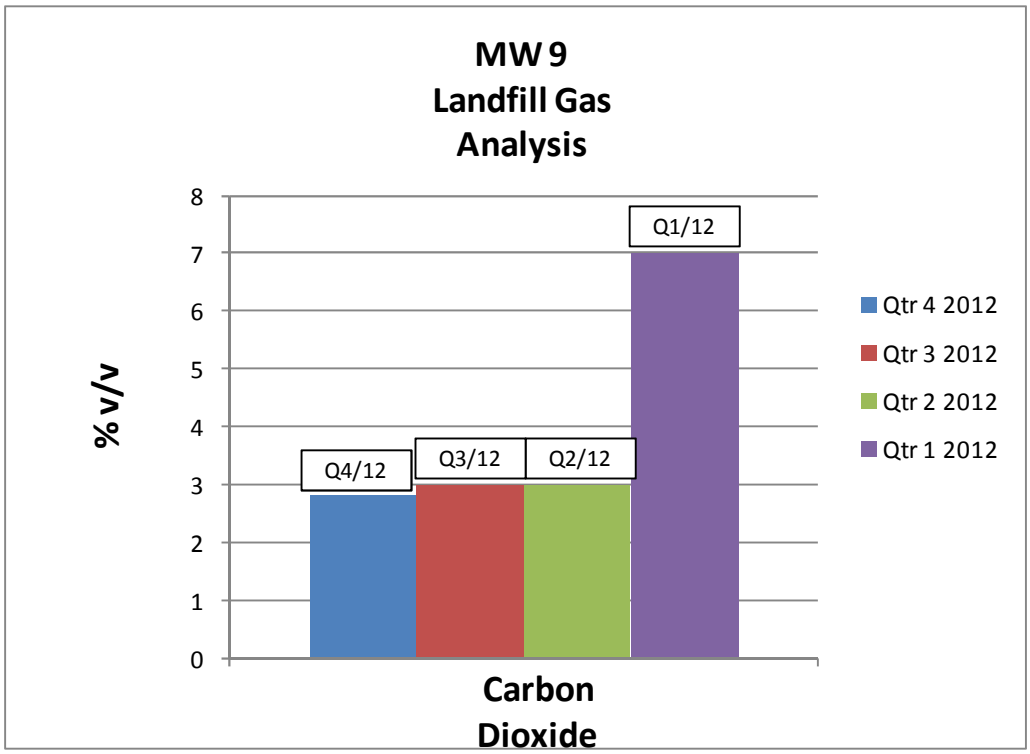
Landfill Gas
Analysis
8
7
6
5
4
3
2
1
0
% v/v
Q1/12
Q3/12
Q2/12
Q4/12
Qtr 4 2012
Qtr 3 2012
Qtr 2 2012
Qtr 1 2012
Methane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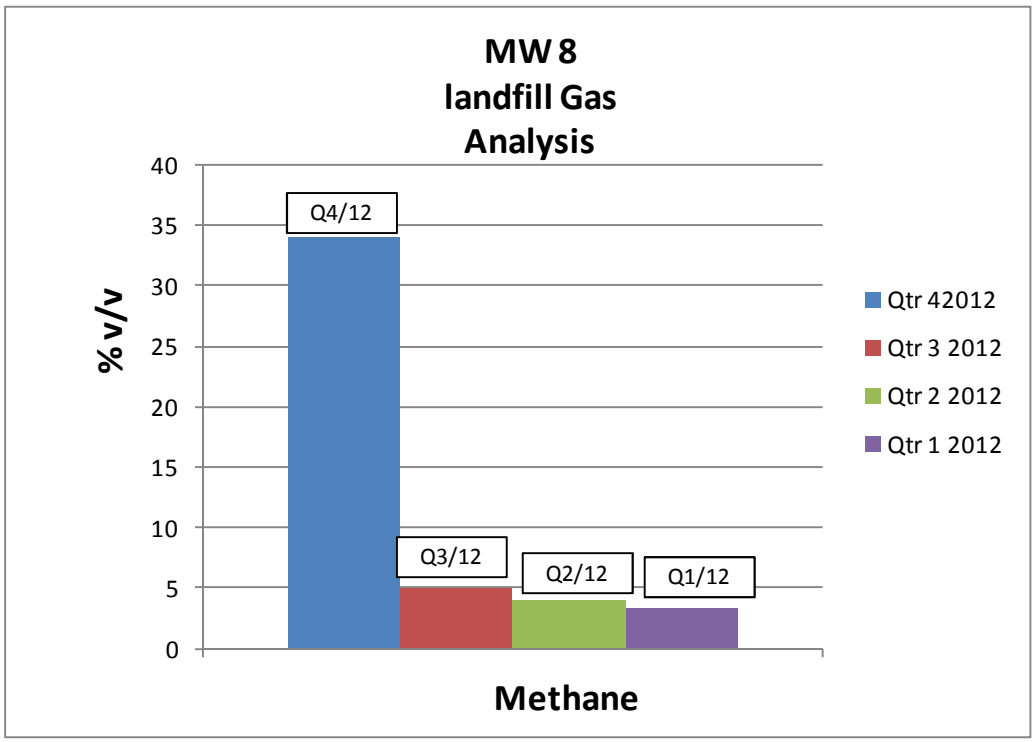
Landfill Gas
Analysis
% v/v
8
7
6
5
4
3
2
1
0
Q1/12
Q4/12
Q3/12
Q2/12
Qtr 4 2012
Qtr 3 2012
Qtr 2 2012
Qtr 1 2012
Carbon
Dioxide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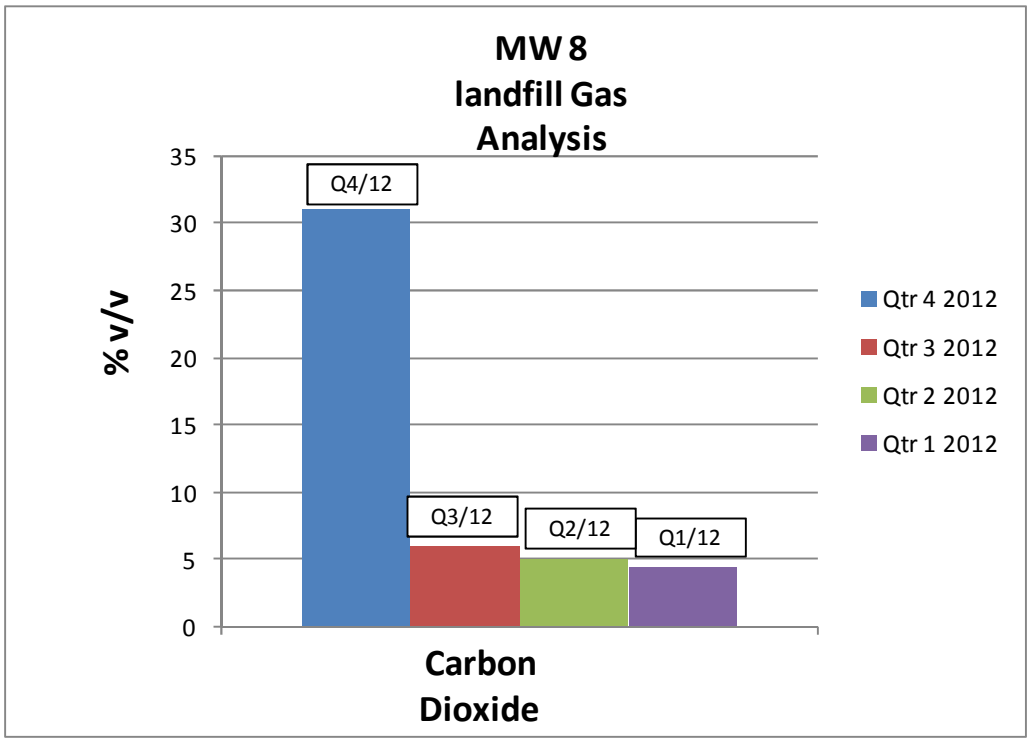
landfill Gas
Analysis
% v/v
40
35
30
25
20
15
10
5
0
Q4/12
Q3/12
Q2/12
Q1/12
Qtr 42012
Qtr 3 2012
Qtr 2 2012
Qtr 1 2012
Methane


MW 8
landfill Gas
Analysis
35
30
25
20
15
10
5
0
% v/v
Q4/12
Q3/12
Q2/12
Q1/12
Qtr 4 2012
Qtr 3 2012
Qtr 2 2012
Qtr 1 2012
Carbon
Dioxide

APPENDIX 2- LANDFILL GAS BREAKDOWN

MW 1

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 12:12	0	0	20.8	0	980
16/10/2012 12:13	0	0	20.8	0	980
16/10/2012 12:14	0	0	20.7	0	980
16/10/2012 12:15	0	0	20.7	0	980
16/10/2012 12:16	0	0	20.7	0	980
16/10/2012 12:17	0	0	20.6	0	980
16/10/2012 12:18	0	0	20.6	0	980
16/10/2012 12:19	0	0	20.7	0	980
16/10/2012 12:20	0	0	20.7	0	980
16/10/2012 12:21	0	0	20.6	0	980
16/10/2012 12:22	0	0	20.6	0	980

MW 2

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 12:34	0	0	20.9	0	980
16/10/2012 12:35	0	0	20.9	0	980
16/10/2012 12:36	0	0	20.9	0	980
16/10/2012 12:37	0	0	20.9	0	980
16/10/2012 12:38	0	0	20.9	0	980
16/10/2012 12:39	0	0	21	0	980
16/10/2012 12:40	0	0	20.9	0	980
16/10/2012 12:41	0	0	20.8	0	980
16/10/2012 12:42	0	0	20.8	0	980
16/10/2012 12:43	0	0	20.9	0	980
16/10/2012 12:44	0	0	21	0	980

MW 3

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 13:14	6.1	5.7	16.8	0	979
16/10/2012 13:15	4.6	4.5	17.6	0	979
16/10/2012 13:16	4.3	3.9	17.8	0	979
16/10/2012 13:17	3.4	3.3	18.5	0	979
16/10/2012 13:18	3.5	3.4	18.5	0	979
16/10/2012 13:19	3.4	3.3	18.4	0	979
16/10/2012 13:20	3.6	3.6	18.2	0	979
16/10/2012 13:21	3.6	3.6	18.2	0	979
16/10/2012 13:22	3.5	3.4	18.4	0	979
16/10/2012 13:23	3.5	3.4	18.4	0	979
16/10/2012 13:24	3.6	3.6	18.2	0	979

MW 6

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 10:03	0	2.1	18.2	0	979
16/10/2012 10:04	0	2.1	18.3	0	979
16/10/2012 10:05	0	0.3	19.5	0	979
16/10/2012 10:06	0	0.9	19.2	0	979
16/10/2012 10:07	0	1.7	18.7	0	979
16/10/2012 10:08	0	1.6	18.6	0	979
16/10/2012 10:09	0	1.6	18.6	0	979
16/10/2012 10:10	0	1.5	18.7	0	979
16/10/2012 10:11	0	1.5	18.8	0	979
16/10/2012 10:12	0	1.4	18.9	0	979
16/10/2012 10:13	0	1.4	18.9	0	979

MW 7

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 14:03	0.2	0.4	19.7	0	978
16/10/2012 14:04	0.2	0.4	19.8	0	978
16/10/2012 14:05	0.2	0.4	19.8	0	978
16/10/2012 14:06	0.2	0.4	19.7	0	978
16/10/2012 14:07	0.2	0.3	19.8	0	978
16/10/2012 14:08	0.3	0.3	19.8	0	978
16/10/2012 14:09	0.3	0.3	19.9	0	978
16/10/2012 14:10	0.3	0.3	19.9	0	978
16/10/2012 14:11	0.3	0.3	19.7	0	978
16/10/2012 14:12	0.2	0.4	19.9	0	978
16/10/2012 14:13	0.2	0.3	19.9	0	978

MW 8

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 12:49	33.7	31.2	0.8	0	979
16/10/2012 12:50	33.7	31.2	0.5	0	979
16/10/2012 12:51	33.8	31.2	0.3	0	979
16/10/2012 12:52	33.8	31.2	0.2	0	979
16/10/2012 12:53	33.8	31.2	0.3	0	979
16/10/2012 12:54	33.8	31	0.1	0	979
16/10/2012 12:55	34	31.1	0.1	0	979
16/10/2012 12:56	34	31.1	0.1	0	979
16/10/2012 12:57	34	31.1	0.1	0	979
16/10/2012 12:58	34.1	31.2	0.02	0	979
16/10/2012 12:59	34.1	31.2	0.2	0	979

MW 9

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 10:18	4.4	7.1	11.7	0	979
16/10/2012 10:19	2.2	4	15.4	0	979
16/10/2012 10:20	1.4	2.8	17.1	0	979
16/10/2012 10:21	1.2	2.4	17.6	0	979
16/10/2012 10:22	1.1	2.3	17.8	0	979
16/10/2012 10:23	1	2.2	17.9	0	979
16/10/2012 10:24	1	2	18.1	0	979
16/10/2012 10:25	1.2	2.2	17.9	0	979
16/10/2012 10:26	1.2	2.2	17.9	0	979
16/10/2012 10:27	1.1	2.1	18	0	979
16/10/2012 10:28	1.1	2.1	18	0	979

MW 10S

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 09:23	0	2.5	11.3	0	980
16/10/2012 09:24	0	1.4	15.7	0	980
16/10/2012 09:25	0	1	17.3	0	980
16/10/2012 09:26	0	0.8	17.8	0	980
16/10/2012 09:27	0	0.7	18.2	0	980
16/10/2012 09:28	0	0.6	18.3	0	980
16/10/2012 09:29	0	0.5	18.5	0	980
16/10/2012 09:30	0	0.5	18.7	0	980
16/10/2012 09:31	0	0.5	18.7	0	980
16/10/2012 09:32	0	0.4	18.8	0	980
16/10/2012 09:33	0	0.4	18.8	0	980

MW 10D

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 09:37	0	0.8	18.2	0	980
16/10/2012 09:38	0	0.8	18.1	0	980
16/10/2012 09:39	0	1.1	16.9	0	980
16/10/2012 09:40	0	1.5	15.6	0	980
16/10/2012 09:41	0	2.1	13.1	0	980
16/10/2012 09:42	0	2.5	10.6	0	980
16/10/2012 09:43	0	2.8	6.2	0	980
16/10/2012 09:44	0	3.3	4.5	0	980
16/10/2012 09:45	0	3.6	3.3	0	980
16/10/2012 09:46	0	3.8	2.4	0	980
16/10/2012 09:47	0	4	1.5	0	980

MW 17D

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 10:54	0	0	20.5	0	980
16/10/2012 10:55	0	0	20.5	0	980
16/10/2012 10:56	0	0	20.5	0	980
16/10/2012 10:57	0	0	20.5	0	980
16/10/2012 10:58	0	0	20.5	0	980
16/10/2012 10:59	0	0	20.6	0	980
16/10/2012 11:00	0	0	20.4	0	980
16/10/2012 11:01	0	0	20.4	0	980
16/10/2012 11:02	0	0	20.6	0	980
16/10/2012 11:03	0	0	20.5	0	980
16/10/2012 11:04	0	0	20.5	0	980

MW 17S

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 11:07	0	0	20.5	0	980
16/10/2012 11:08	0	0	20.5	0	980
16/10/2012 11:09	0	0.3	19.7	0	980
16/10/2012 11:10	0	0.3	19.8	0	980
16/10/2012 11:11	0	0.3	19.9	0	980
16/10/2012 11:12	0	0.2	19.9	0	980
16/10/2012 11:13	0	0.1	20.1	0	980
16/10/2012 11:14	0	0.1	20.1	0	980
16/10/2012 11:15	0	0.2	20	0	980
16/10/2012 11:16	0	0.2	19.9	0	980
16/10/2012 11:17	0	0.2	19.9	0	980

MW 18

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 13:03	63.2	33.1	0	0	978
16/10/2012 13:04	63.3	33.3	0	0	978
16/10/2012 13:05	63.2	33.3	0	0	978
16/10/2012 13:06	63.2	33.3	0	0	978
16/10/2012 13:07	63.2	33.3	0	0	978
16/10/2012 13:08	63.2	33.3	0	0	978
16/10/2012 13:09	63.2	33.3	0	0	978
16/10/2012 13:10	63.1	33.4	0	0	978
16/10/2012 13:11	63.1	33.4	0	0	978
16/10/2012 13:12	63.1	33.4	0	0	978
16/10/2012 13:13	63	33.5	0	0	978

MW 19

Date/Time	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
16/10/2012 13:29	38	24.6	0	0	978
16/10/2012 13:30	38.2	24.9	0	0	978
16/10/2012 13:31	38.4	24.8	0	0	978
16/10/2012 13:32	38.4	24.9	0	0	978
16/10/2012 13:33	38.4	24.9	0	0	978
16/10/2012 13:34	38.5	24.9	0	0	978
16/10/2012 13:35	38.4	24.8	0	0	978
16/10/2012 13:36	38.3	24.8	0	0	978
16/10/2012 13:37	38.2	24.7	0	0	978
16/10/2012 13:38	38.2	24.8	0	0	978
16/10/2012 13:39	38.2	24.8	0	0	978

APPENDIX 3- ANALYSIS METHODS

ELS LTD INAB ACCREDITATION SCHEDULE SUMMARY SHEET

Miscellaneous (P,G,W,S)
Ammonia/Ammonium 0.007-1mg/l N EW003
Chloride 2.6-250 mg/l EW015
Flouride 0.1 - 2 mg/l EW137
COD 8-1500 mg/l EW094
Nitrate 0.12-50 mg/l N EW034
Nitrite 0.013-1 mg/l N EW035
pH 4 – 10 pH Units EW138
Phosphate 0.009-1 mg/l P EW007
TOC 0.25-100mg/l EW123
Total Phosphorous 0.03-1 mg/l P EW002

Miscellaneous (P,G,S)
Bromate 1 to 50ug/l BRO3 (EW137)
Colour 2.5-50mg/l PtCCo (EW021)
Conductivity 132-6000 us/cm EW139
Dissolved Oxygen 1 to 10 mg/l (EW043)
Sulphate 1-250mg/l SO4(EW016)
Suspended Solids 5-1000mg/l (EW013)
Total Dissolved Solids 1-1000mg/l (EW046)
Total Hardness 3-330mg/l CaCO3 (EM099)
Total Oxidised Nitrogen 0.138-51mg/l N (EW051)

Metals EM130 (P,G,S)
Aluminium 5.0 – 500 µg/l
Antimony 0.1 – 10µg/l
Arsenic 0.2 - 20µg/l
Barium 1.0 - 100µg/l
Boron 0.02 – 2mg/l
Cadmium 0.1 – 10µg/l
Calcium 1.0 – 100mg/l
Chromium 1.0 - 100µg/l
Cobalt 1.0 - 100µg/l
Copper 3 - 4000µg/l
Iron 5.0 - 500µg/l
Lead 0.3 - 30µg/l
Magnesium 0.3 – 20mg/l
Manganese 1.0 - 100µg/l
Mercury 0.02 - 2µg/l
Molybdenum 1.0 - 100µg/l
Nickel 0.5 - 50µg/l
Potassium 0.2 – 20mg/l
Selenium 0.2 - 20µg/l
Sodium 0.5 – 50mg/l
Strontium 1.0 - 100µg/l
Tin 1.0 - 100µg/l
Vanadium 1.0 - 100µg/l
Zinc 1.0 - 100µg/l

SI439 Potable Water VOCs & THM EO025 (P,G,S)
Benzene 0.1-35 µg/l
1.2-Dichloroethane 0.1-35 µg/l
Tetrachloroethene 0.1-35 µg/l
Trichloroethene 0.1-35 µg/l
Chloroform 1.0-150 µg/l
Bromoform 1.0-35 µg/l
Dibromochloromethane 1.0-35 µg/l
Bromodichloromethane 2.0-35 µg/l

Other VOC's EO025 (P,G,S)
Bromomethane 0.5 - 35 µg/l
Ethyl Ether/Diethyl Ether0.5 - 35 µg/l
11 Dichloroethene0.5 - 35 µg/l
Iodomethane/Mehyl Iodide 0.5 - 35 µg/l
Carbon Disulphide 0.5 - 35 µg/l
Allyl Chloride0.5 - 35 µg/l
Methylene Chloride/DCM 5.0 - 35 µg/l
2-Propenenitrile/Acrylonitrile 2.0 - 35 µg/l
Chlormethyl Cyanide 0.5 - 35 µg/l
Hexachlorobutadiene0.5 - 35 µg/l
Trans-1,2 Dichloroethene0.5 - 35 µg/l
MtBE0.5 - 35 µg/l
11 Dichloroethane0.5 - 35 µg/l
22 Dichloropropane0.5 - 35 µg/l
Cis-12 Dichloroethene0.5 - 35 µg/l
Methyl Acrylate5.0 - 35 µg/l
Bromochloromethane0.5 - 35 µg/l
Tetrahydrofuran5.0 - 35 µg/l
111 Trichloroethane0.5 - 35 µg/l
1-Chlorobutane0.5 - 35 µg/l
Carbon Tetrachloride0.5 - 35 µg/l
11 Dichloropropene0.5 - 35 µg/l
12 Dichloropropane0.5 - 35 µg/l
Dibromomethane0.5 - 35 µg/l
Methyl Methacrylate0.5 - 35 µg/l
13 Dichloropropene, cis2.0 - 35 µg/l
MIBK/4 Methyl 2 Pentanone 2.0 - 35 µg/l
Toluene0.5 - 35 µg/l
13 Dichloropropene,trans2.0 - 35 µg/l
Ethyl Methacrylate2.0 - 35 µg/l
112 Trichloroethane0.5 - 35 µg/l
13 Dichloropropane0.5 - 35 µg/l
2 Hexanone1.0 - 35 µg/l
12 Dibromoethane0.5 - 35 µg/l
Chlorobenzene0.5 - 35 µg/l
1112 Tetrachloroethane2.0 - 35 µg/l
Ethyl Benzene0.5 - 35 µg/l
m & p Xylene0.5 - 35 µg/l
O Xylene0.5 - 35 µg/l
Stryene2.0 - 35 µg/l
Isopropyl Benzene0.5 - 35 µg/l
Bromobenzene0.5 - 35 µg/l
1122 Tetrachloroethane0.5 - 35 µg/l
123 Trichloropropane2.0 - 35 µg/l
Propyl Benzene0.5 - 35 µg/l
2-Chlorotoluene0.5 - 35 µg/l
4 Chlorotoluene0.5 - 35 µg/l
135 Trimenthylbenzene0.5 - 35 µg/l
Tert Butyl Benzene0.5 - 35 µg/l
124 Trimethlbenzene0.5 - 35 µg/l
Sec Butyl Benzene0.5 - 35 µg/l
13 Dichlorobenzene0.5 - 35 µg/l
P Isopropyltoluene0.5 - 35 µg/l
14 Dichlorobenzene0.5 - 35 µg/l
12 Dichlorobenzene0.5 - 35 µg/l
N Butyl Benzene0.5 - 35 µg/l
Hexachloroethane5.0 - 35 µg/l
12 Dibromo 3Chloropropane 2.0 - 35 µg/l
124 Trichlorobenzene0.5 - 35 µg/l
123 Trichlorobenzene0.5 - 35 µg/l

PAH EO129 (P,G,S)
Range 0.01 - 0.2 µg/l
Acenaphthene
Benzo (a) Anthracene
Benzo (a) Pyrene
Benzo (b) Fluoranthene
Benzo (ghi) Perylene
Benzo (k) Fluoranthene
Chrysene
Dibenzo (ah) Anthracene
Fluoranthene
Fluorene
Indeno (123-cd) Pyrene
Phenanthrene
Pyrene

Acid Herbicides (P,G,S)
Range 0.01 - 0.2 µg/l
2,4,5-T H
2,4-D H
2,4-DB H
MCPA H
Picloram H

Organophosphorus Pesticides(P,G,S)
Range 0.01 - 0.2 µg/l
Famphur OP
Methyl Parathion OP
Parathion OP
Thionazin OP

Organochlorine Pesticides (P,G,S)
Range 0.01 - 0.2 µg/l
Aldrin
BHC Alpha isomer OC
BHC Beta isomer OC
BHC Delta isomer OC
Dieldrin OC
Endosulphan Alpha isomer OC
Endosulphan Beta isomer OC
Endosulphan Sulphate OC
Endrin OC
Heptachlor Epoxide OC
Heptachlor OC
Lindane OC
P,P' DDE OC
P,P'-DDD OC
P,P'-DDT OC

Notes
1.Sample Matrix:P=Potable Water (Drinking) , G=Ground Water , S=Surface Water, W=Waste Water

APPENDIX 4 – FIELD SHEETS

Landfill Gas Monitoring Form

Facility Name: Ballydonaugh **Waste Licence No:** 91-01	**Facility Address:** Tandragee Ballydonaugh Co Cavan
Licensee: Cavan CC	
Date of Licensing: 2003	**Date of sampling:** 16/11/12
Instrument Used: GA 2000	**Date next full calibration:** 2013 **Last field calibration: (inc date & gases)**
Monitoring Personnel: Ryan Keating	**Weather:** Dry

Results

Station Number	Time	GA2000 ID	CH_4	CO_2	O_2	CO	H_2S	Barometric Pressure (mbar)	Comments
MW10S	09:23	✓	0	2.5	11.3	✓	0	980	
MW10D	09:37	✓	0	0.8	18.2	✓	0	980	
MW6	10:03	✓	0	2.1	18.2	✓	0	979	
MW9	10:18	✓	6.4	7.1	11.7	✓	0	979	
MW17D	10:54	✓	0	0	20.5	✓	0	980	
MW17S	11:07	✓	0	0	20.5	✓	0	980	
MW1	12:12	✓	0	0	20.8	✓	0	980	
MW2	12:36	✓	0	0	20.9	✓	0	980	
MW8	12:49	✓	33.7	31.2	0.8	✓	0	979	
MW18	13:03	✓	63.2	33.1	0	✓	0	978	NEW gas/leachate well
MW3	13:14	✓	6.1	5.7	16.8	✓	0	979	

General Comments:

MW19	13:29	✓	38.0	24.6	0	✓	0	978	NEW gas/leachate well
MW7	14:03	✓	0.2	0.4	19.7	✓	0	978	

ON SITE SAMPLING FORM

Facility Name: Ballyboroughs	**Waste Licence No:** 91-01
Report To: Cavan County Council 16/10/12	
Sampling Date:	**Sample Type (GW, SW,Leachate)** All
Personnel: Brian Heath	**Weather:** Dry
Other Remarks:	**GPS:**

Sample Ref No	Sample Type	Time	DO Level	Elec Cond (us)	pH pH units	Temp °C	Visual	Instrument
MW16D	GW		5.3	270	7.30	10.5	Heavy silt	
MW16S	GW		7.7	265	7.08	10.8	Clear	
CAP	GW		9.2	310	7.31	9.5	Clear	
MW15S	GW		5.4	309	6.88	11.8	Clear	
MW15D	GW		7.1	314	7.95	10.3	Heavy silt	
SW1	SW		7.2	295	7.13	7.5	Straw	
MW17D	GW		6.9	409	7.77	11.3	Clear	
SW3	SW		5.7	281	7.17	8.9	Straw	
MW10D	GW		8.0	410	7.96	10.4	Clear	

COMMENTS:
2 new wells along Road 17S + 17D, unable to sample 17S on day of monitoring. 10D flooded

Boylan engineering

CAVAN COUNTY COUNCIL

CLOSED LANDFILL MONITORING INTEGRITY FORM

SITE Ballaborough DATE 16/10/12 PERSONNEL Fiona Keating

ITEM	CONDITION			COMMENTS
	GOOD	NEEDS MAINTENANCE	N/A	
GROUNDWATER MONITORING WELLS	✓			New GW wells to be labelled 17S + 17D
-Labeled	✓			
-Well cap integrity	✓			
-Water drainage	✓			
-Locks	✗	✓		
LANDFILL GAS VENTS				✱✱
-Riser condition	✓			
-Concrete collar condition	✓			
-Screen condition	✓			
LANDFILL GAS MONITORING WELLS				New gas wells to be labelled 18 + 19 Replacement locks to be fitted by Boylan Eng in October
-Labeled	✓			
-Well cap integrity	✓			
-Water drainage	✓			
-Traffic protection	✓			
-Concrete collar condition	✓			
-Screen Condition	✓			
-Locks	✗	✓		
SURFACE WATER MONITORING LOCATIONS				
-Access	✓			
-Disturbance	✓			

Cavan County Council Groundwater & Leachate Sampling Ref:

Site Reference: Ballyhaugh **Permit No.** 91-01 **Date:** 16/10/12 **Personnel:** B Keating

Sample Ref (Shallow /Deep)	Depth of Well (m) *A*	Depth of water below Ground Level (m) *B*	Depth of Water column (m) *A-B= h*	Diameter of Well (m) *C*	Radius of Well (m) *(C/2)= r*	Radius Squared (m^2) r^2	Volume of Water in Well (m^3) $\Pi r^2 h$	Volume of Water in well – Litres (m3 x 1000)	Volume of water to purge (Litres x 3)	Time to Purge (mins)
16D	27	1.17	25.83	0.05	0.025	0.000625	0.056691	50.69	152.07	26 min purge
16S	5	1.48	3.52	0.05	0.025	0.000625	0.006908	6.908	20.72	5 min purge
15D	25	1.6	23.4	0.05	0.025	0.000625	0.045923	45.92	137.76	23 min purge
15S	5	1.72	3.18	0.05	0.025	0.000625	0.006241	6.24	18.72	5 min purge
17D		1.35		0.05	0.025	0.000625	0.038612	38.66	115.98	20 min purge

10 D 25.3 5.4 19.7

APPENDIX 5 – CHAIN OF CUSTODY/SAMPLE SUBMISSION

els

Environmental Laboratory Services Ltd
[illegible]
[illegible] Industrial Park
[illegible]
Cork
Tel: [illegible]

SAMPLE SUBMISSION FORM

3989

DETAILS TO APPEAR ON ANALYSIS REPORT

Contact Name: [illegible]
Address: Mallow, Co. Cork

Customer Name: Boylan Eng
PO Number:
NOTE: Use a separate sheet for different PO Numbers. For all customers a PO Number must be provided with the samples

CONTRACT DETAILS

ELS Quote No.: [illegible]
NOTE: To reduce potential for error this field must be completed. Use a separate sheet for different Quote Numbers

Results Due (Tick): [illegible]

NOTE: Standard turn around time is 10 working days and 15 working days for test subcontracted. Deviations should be agreed in advance and may incur an extra charge

SAMPLE DETAILS

Number	Sample Reference (NOTE: Whatever appears in this section, is the ONLY detail that will appear on the analysis report (Do not write the required detail on the bottles as it is not easily read there))	Tests Requested (NOTE: To reduce potential for error please complete this field clearly indicating per quote/per sheet attached or list the specific tests below)	Number of bottles submitted	Sample Type (Drinking Water (DW), Ground Water (GW), Surface Water (SW), Waste Water (WW), Sludge, Soil/Silt, Solvent, Air)
1	MW 16D	See QN	Full kit	GW
2	MW 16S	"	"	"
3	MW 15D	"	"	"
4	MW 15S	"	"	"
5	MW 10D	"	"	"

ONLY FIVE SAMPLES ALLOWED PER SUBMISSION SHEET

ADDITIONAL INFORMATION AND SIGNATURES

To be filled by the person submitting samples

Signature: [illegible]
Phone No.: [illegible]
Date: 6/10/17
No. samples submitted: 6
No. of pages: 1 of 1
Additional Info (if any):

To be filled by ELS Ltd

Signature: [illegible]
Date: 12.10
Time:
Condition: Satisfactory / Unsatisfactory - See notes above
Additional Info.: FW

NOTES FOR CUSTOMER

1. Feel free to save this submission sheet to your desktop
2. This form is designed to allow key details to be typed in and re-used as necessary
3. Failure to submit this form with samples may lead to errors which may be outside the control of ELS Ltd
4.
5.

NOTES FOR ELS LTD

1. If the customer details are not on the system or if the name and address differ greatly with that on the system consult the Customer Service Agent
2. Always ensure the "Contact Name" above is used on the report, if that field is blank use the default name on the system
3. Click "Po Req" where samples have been received from County Councils without PO Numbers
4. Always log in samples with different PO Numbers on different reports
5. Do not enter sample details in block capitals eg sample ref ACORN DRINKING WATER should read Acorn Drinking Water

els

SAMPLE SUBMISSION FORM

3990

DETAILS TO APPEAR ON ANALYSIS REPORT

Contact Name / Address: [illegible]

Customer Name: Boylan Eng

PO Number:

NOTE: Use a separate sheet for different PO Numbers. For all customers a PO Number must be provided with the samples.

CONTRACT DETAILS

ELS Quote No.:

NOTE: To reduce potential for error this field must be completed. Use a separate sheet for different Quote Numbers.

Results Due (Tick):

NOTE: Standard turnaround time is 10 working days and 15 working days for test sub-contracted. Deviations should be agreed in advance and may incur an extra charge.

SAMPLE DETAILS

Number	Sample Reference — NOTE: Whatever appears in this section is the ONLY detail that will appear on the analysis report (Do not write the required detail on the bottles as it is normally not clear)	Tests Requested — NOTE: To reduce potential for error please complete this field clearly indicating per quote, per sheet attached or list the specific tests below	Number of bottles submitted	Sample Type — Drinking Water (DW), Ground Water (GW), Surface Water (SW), Waste Water (WW), Sludge, Soil, Oil, Solvent, Air
6	MW 17 D	see ON	full kit	GW
2				
3				
4				
5				

ONLY FIVE SAMPLES ALLOWED PER SUBMISSION SHEET

ADDITIONAL INFORMATION AND SIGNATURES

To be filled by the person submitting samples

Signature: [signature]

Phone No.: [illegible]

Date: 16/10/12

No. samples submitted: 6

No. of pages: 2 of 4

Additional Info:

To be filled by ELS Ltd

Signature: [signature]

Date: 17/10

Time:

Condition: Satisfactory / Unsatisfactory - See notes above

Additional Info: FW

NOTES FOR CUSTOMER

1. Feel free to save this submission sheet to your desktop
2. This form is designed to allow key details to be typed, saved and re-used as necessary
3. Failure to submit the form with samples may lead to errors which may be outside the control of ELS Ltd
4.
5.

NOTES FOR ELS LTD

1. If the customer details are not on the system or if the name and address differ greatly with that on the system consult the Customer Service Agent
2. Always ensure the "Contact Name" above is used on the report; if that field is blank use the default name on the system
3. Click "Po Req" where samples have been received from County Councils without PO Numbers
4. Always log in samples with different PO Numbers on different reports
5. Do not enter sample details in block capitals eg sample ref ACORN DRINKING WATER should read Acorn Drinking Water

els

Model Industrial Park
[illegible]
Cork
Tel: [illegible]

SAMPLE SUBMISSION FORM

3992

DETAILS TO APPEAR ON ANALYSIS REPORT

Contact Name: [illegible]
Address: Boylan Eng [illegible] Cavan

Customer Name: Boylan Eng
PO Number:
NOTE: Use a separate sheet for different PO Numbers
For all customers a PO Number must be provided with the samples

CONTRACT DETAILS

ELS Quote No: [illegible]
NOTE: To reduce potential for error this field must be completed
Use a separate sheet for different Quote Numbers

Results Due (Tick)

NOTE: Standard lead time is 10 working days and 15 working days for test sub-contract.
Deviations should be agreed in advance and may incur an extra charge

SAMPLE DETAILS

Number	Sample Reference NOTE: Whatever appears in this section, is the ONLY detail that will appear on the analysis report (Do not write the required detail on the bottles as it is normally not clear)	Tests Requested NOTE: To reduce potential for error please complete this field clearly indicating per quote per sheet attached or list the specific tests below	Number of bottles submitted	Sample Type Drinking Water (DW), Ground Water (GW), Surface Water (SW), Waste Water (WW), Sludge, Soil, Silt, Solvent, Air
1	SW 1	see QN	full kit	SW
2	SW 3	"	"	"
3	CAP Discharge	"	"	"
4				
5				

ONLY FIVE SAMPLES ALLOWED PER SUBMISSION SHEET

ADDITIONAL INFORMATION AND SIGNATURES

To be filled by the person submitting samples	
Signature	[signature]
Phone No	04[illegible]
Date	18/10/12
No. samples submitted	3
No. of pages	4 of 4
Additional Info (if any)	

To be filled by ELS Ltd	
Signature	[signature]
Date	19.10
Time	
Condition	Satisfactory / Unsatisfactory - See notes above
Additional Info.	FW

NOTES FOR CUSTOMER

1. Feel free to save this submission sheet to your desktop
2. This form is designed to allow key details to be typed, saved and re-used as necessary
3. Failure to submit the form with samples may lead to errors which may be outside the control of ELS Ltd
4.
5.

NOTES FOR ELS LTD

1. If the customer details are not on the system or if the name and address differ greatly with that on the system consult the Customer Service Agent
2. Always ensure the "Contact Name" above is used on the report, if that field is blank use the default name on the system
3. Click "Po Req" where samples have been received from County Councils without PO Numbers
4. Always log in samples with different PO Numbers on different reports
5. Do not enter sample details in block capitals e.g sample ref ACTIVE DRINKING WATER should read Acorn Drinking Water

els

Environmental Laboratory Services Ltd
Acorn Business Campus,
Mahon Industrial Park,
Blackrock,
Cork
Tel. 021-[illegible]

SAMPLE SUBMISSION FORM

3991

DETAILS TO APPEAR ON ANALYSIS REPORT

Contact Name: Brona Keating
Address: Boylan Eng, Mullagh, Cavan

Customer Name: Boylan Eng
PO Number:
NOTE: Use a separate sheet for different PO Numbers. For all customers a PO Number must be provided with the samples

CONTRACT DETAILS

ELS Quote No.: 1407

NOTE: To reduce potential for error this field must be completed. Use a separate sheet for different Quote Numbers

Results Due (Tick): [illegible] ✓

NOTE: Standard turnaround time is 10 working days and 15 working days for sub-contract. Deviations should be agreed in advance and may incur an extra charge

SAMPLE DETAILS

Number	Sample Reference (NOTE: Whatever appears in this section, is the ONLY detail that will appear on the analysis report. (Do not write the required detail on the bottles as it is normally not clear))	Tests Requested (NOTE: To reduce potential for error please complete this field clearly indicating per quote per sheet attached or list the specific tests below)	Number of bottles submitted	Sample Type (Drinking Water (DW), Ground Water (GW), Surface Water (SW), Waste Water (WW), Sludge, Soil, Silt, Solvent, Air)
1	MW 11	See QN	Full kit	Leachate
2	MW 12	See QN	" "	"
3				
4				
5				

ONLY FIVE SAMPLES ALLOWED PER SUBMISSION SHEET

ADDITIONAL INFORMATION AND SIGNATURES

To be filled by the person submitting samples:
Signature: B Keating
Phone No.: 0469280000
Date: 16/10/17
No. samples submitted: 2
No. of pages: 3 of 11
Additional Info (if any):

To be filled by ELS Ltd:
Signature: [illegible]
Date: 17.10
Time:
Condition: Satisfactory / Unsatisfactory - See notes above
Additional Info.: FW

NOTES FOR CUSTOMER

1. Feel free to save this submission sheet to your desktop
2. This form is designed to allow key details to be typed, saved and re-used as necessary
3. Failure to submit the form with samples may lead to errors which may be outside the control of ELS Ltd
4.
5.

NOTES FOR ELS LTD

1. If the customer details are not on the system or if the name and address differ greatly with that on the system consult the Customer Services Agent
2. Always ensure the "Contact Name" above is used on the report, if that field is blank use the default name on the system
3. Tick "Po Req" where samples have been received from County Councils without PO Numbers
4. Always log in samples with different PO Numbers on different reports
5. Do not enter sample details in block capitals eg sample ref ACORN DRINKING WATER should read Acorn Drinking Water

APPENDIX 6 – CALIBRATION CERTIFICATE-GA2000

Calibration Certificate

Issued by	Environmental monitoring	**Certificate number**	1125

Instrument	GA2000	**Calibrated by**	AT

Serial no	531	**Ambient temp**	17
Service done	09/11/11	**Ambient pressure**	1001
Calibration date	02/02/2012	**Calibration due**	02 Feb 2013
Job number	NA	**Linearity check**	n/a
Logger	Pass	**Battery**	Pass
Filter	pass	**Overall result**	pass

Test Method
The instrument was calibrated by applying a know concentration of gas at a set flow rate and pressure.
The results are recorded on this sheet **after** adjustment and a constant reading is obtained.
The results are compared to that of a reference certified set of gases

Test reference	Cert tracability	Instrument reading	pass/fail
CO2	5.0%	4.7%	pass
02	17.8%	17.9%	pass
CH4	2.5%	2.3%	pass
CO	199ppm	197ppm	pass
H2S	5ppm	5.0ppm	pass

Address
environmental monitoring
Unit 9a
Lake District Business Park
Mint Bridge Road
Kendal
Cumbrial
Tel 01782 435100
email : **environmonitoring@btconnect.co.uk**

APPENDIX D
Declaration

Cavan County Council
Comhairle Chontae an Chabháin
Teach Na Cúirte, An Cabháin
Courthouse, Cavan

Declaration

Bailieborough Landfill AER W0091-01

Cavan County Council hereby certifies that the content of the full pdf. AER W0091-012012AER.pdf uploaded to the EPA website is a true copy of the original AER.

Signed Sinead Fox Dated 15/3/13

Sinead Fox
Landfill Operations Manager
Cavan County Council